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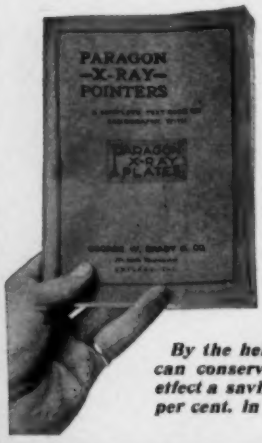

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A. H. Crane.

THE AMERICAN JOURNAL OF ROENTGENOLOGY

Editor, P. M. Hickey, M. D., Detroit

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DR. AUGUSTUS WARREN CRANE

DR. AUGUSTUS WARREN CRANE was born in Adrian, Michigan, November 13, 1868. After graduating from the Adrian High School, he entered the literary department of the University of Michigan, and was graduated from the medical department in 1894 as valedictorian of his class.

In the same year he went to Kalamazoo, Michigan, and entered upon the general practice of medicine, surgery and obstetrics. In his first years he specialized in laboratory work, and in 1895 was appointed city bacteriologist, the first in the State of Michigan. His first medical paper, before the Kalamazoo Academy of Medicine in 1895, was on "Laboratory Methods of Diagnosis." The records of the Academy contain the following titles which show the trend of Dr. Crane's work at this period: In 1896, "Pathology of Bright's Disease"; "The Clinical Value of the Examination of the Blood"; "A Rapid Method for the Early Diagnosis of Typhoid Fever." In 1897, "New Chapters in the Biology of the Blood"; "A Phase of the Treatment of Chronic Diseases of the Stomach."

In 1898, before the Michigan State Society, he read a paper on "Missing Links in the Clinical Examination of the Blood." This paper was an attempt to discover the biological meaning of the different blood cells by a study of the blood of mammals, reptiles, fishes, birds, worms, crustaceans and insects. Advantage was taken of visiting menageries to obtain the blood of rare animals.

However, before this, in March, 1897, Dr. Crane had installed his first *x*-ray machine—a 12-inch coil operated by a battery and a mechanical break. The battery he made himself. The minutes of the Kalamazoo Academy of Medicine show that on September 27, 1898 he read a paper, illustrated by plates, on "The Roentgen Rays in Diseases of the Lungs," and by vote of the Academy was requested to publish it. Under title of "Skiascopy of the Respiratory Organs" it appeared in the *Philadelphia Medical Journal* of March, 1899.

Following this publication he was elected to membership in the London Roentgen Ray Society in 1899, and was invited by Dr. David Walsh of London to contribute the section on "Medical Diagnosis" for his book, "The Roentgen Rays in Medical Work." This was published in 1902.

Another result, illustrating a now vanished view point, was that Dr. Crane received from a friend, an American internist of note, a remonstrance on his turning aside from a really important piece of work like that on the blood, for anything of such minor and transitory importance as the *x*-ray!

Dr. Crane's first stomach and colon plates were made December 8, 1905. In March, 1906, he read before the Kalamazoo Academy a paper, illustrated by plates, on "The Position and Shape of the Stomach and Intestines During Life"; in June, 1907, "Gastroptosis—X-Ray Illustrations"; on December 10, 1907, discussed "Gastric Ulcer" and showed *x*-ray plates.

Dr. Crane's first paper before the American X-Ray Society, "X-Ray Evidence in Gastric Ulcer," was read at the New York meeting in 1908. The following year he read a paper before the American Medical Association at Atlantic City on "X-Ray Evidence in Gastric Cancer," at which time he made an exhibit of 72 gastro-intestinal plates.

His first plate showing an appendix was made February 3, 1906. Three appendix plates, along with many stomach and intestinal plates, were demonstrated at the Jackson meeting of the Michigan State Medical Society, May, 1906. These plates and others were exhibited at the Niagara Falls meeting of the American Roentgen Ray Society in 1906.

In March, 1901, in a lecture at the University of Michigan he described a method of operating a coil from an alternating circuit by means of an electrolytic interrupter. This paper, "Practical Office Methods of Medical Diagnosis," was published in *American Medicine*. It led to the general use of the Wehnelt interrupter for running *x*-ray coils on the alternating circuit.

At the Cincinnati meeting of the American Roentgen Ray Society, 1907, he read a paper on "Specific Immunity and X-Ray Therapeutics," which demonstrated for the first time the effect of the *x*-ray in producing an immunity parallel to that produced by vaccines. This explained the curative action of the *x*-ray in numerous diseases having nothing in common excepting a disease-producing agent capable of acting as a vaccine. In 1911 a companion paper appeared in *The American Journal of the Medical Sciences* on "Vaccine Therapy and a Simplified Opsonic Index." Incidentally this paper described an original method of preparing and preserving vaccines in the dry state.

At the Detroit meeting of the American Roentgen Ray Society in 1910 he demonstrated the method of estimating the size of the pancreas by the arc of the duodenum and the position of the hilum of the spleen.

In 1915 "Roentgenology of Gastric Cancer" was contributed to the *International Abstract of Surgery*. At the Detroit meeting of the American

Medical Association in June of this year, Dr. Crane read a paper on "Roentgenocardiograms—Polygraphic Strip Tracings of the Pulsations of Heart Chambers." The term roentgenocardiogram was coined by Dr. Crane to conform with the term electrocardiogram.

Until 1906 Dr. Crane carried on a large general practice and did considerable surgery. He performed his first gastro-enterostomy in 1906 and removed a gall bladder for gallstones in June, 1900. Both patients are still living. In 1906 he confined his practice to internal medicine, in which he was the more vitally interested. In 1908 he was elected president of the Kalamazoo Academy of Medicine. Since 1915 he has restricted his work to diagnosis and a consultation practice. Roentgenology has become his chief interest. But those who have visited him have found that his system of case records includes a history of the case, a detailed physical examination and full laboratory findings, as well as roentgenological data. His years of experience in general practice and training as an internist are thus brought to bear upon the problems of roentgenology.

SKIASCOPY OF THE RESPIRATORY ORGANS

BY A. W. CRANE, M.D.

KALAMAZOO MICH.

The Editor takes pleasure in presenting the readers of the JOURNAL with extracts from the original article of Dr. Crane which was published in 1899 in the *Philadelphia Medical Journal* of March. While the original article is too long to be reprinted in its entirety, we think that the following extracts will give a good idea of the pioneer work which was done by Dr. Crane, and which we think has not been sufficiently appreciated by our American workers. The English writers have appreciated it sufficiently to reprint most of the article in some of their textbooks.

In these days when it has been the fashion to constantly refer to the work done in the great medical centers both abroad and in this country, it is instructive to review what has been accomplished by one man through the sheer force of his own initiative and his brilliant intellect.

THE necessity or desirability of marking the radial axis is slight when the examination is with the fluoroscope. The fluoroscopic screen should be small, about 5 by 7 inches, and should be kept opposite the platinum reflector. The distortion will then be inconsiderable and may be disregarded for the practical reason that the patient should be frequently moved before the fluoroscope, as different areas of the chest are inspected. This method of moving the patient instead of the fluoroscope is put in practice for the recumbent position by having the stretcher rest upon large, easy-rolling casters, so that it can be moved by one or both hands. (See Fig. 2.)

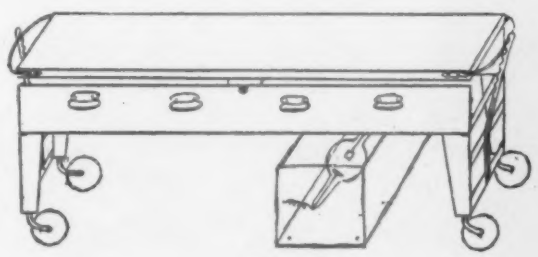

FIG. 2.

The canvas stretcher which forms the top of the table, is pivoted and is easily turned from side to side so as to bring successive portions of the thorax over the platinum anode. Also, either end may be raised or lowered. It is convenient to have the fluoroscope held to the eyes by a rubber band passing around the head, as in the case of the head-mirror. The fact that the fluoroscope is hanging downward during the examination, as the physician bends over his patient, frees this device from objections on account of the weight and leverage of the instrument.

When the patient is examined in the upright position, there are some difficulties. There should be a firm backing against which the patient may stand, and which

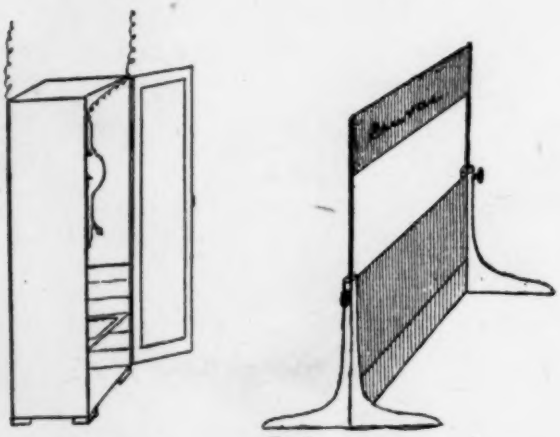

Fig. 3.

will keep him a constant distance from the tube. (See Fig. 3.) He can then be moved from side to side. The canvas strip should be adjusted opposite the tube. The patient should stand against the canvas, between it and the tube. The fluoroscope may then be moved over the canvas strip, which will make the third of the lung under examination. The tube should be adjusted opposite the upper third of the thorax, which may be examined. The tube should then be readjusted opposite the middle third, after the examination of which it should be placed opposite the lower third. This necessitates turning the current on and off and readjusting the tube three times, but in reality this does not make the examination unnecessarily long, and gives rest to the patient, time for the tube to cool, and an opportunity to record results as they are obtained. The ideal way would be to have the tube and fluoroscope held in a frame so that, when the fluoroscope is moved over the patient's body, the tube would automatically be moved in like degree. This would, however, call for an unnecessary complication of apparatus, which would still farther remove an *x*-ray examination from the reach or inclination of the general practitioner.

A routine and systematic plan of examination is desirable. No point is then overlooked, and time is saved. The *x*-ray examination should be the final one. The physical examination by inspection, palpation, percussion, and auscultation should be no less thorough because the roentgen ray is to follow. If there be a sputum it should be examined in every case. The examination should be begun with the fluoroscope. If there be a condition present which, on account of its interest or its obscurity, is worthy of a skiagraphic record or delineation, then a dry-plate may be exposed. The fluoroscope is superior to the skiagraph in the examination of the lungs, because the skiagraph gives only one view and shows nothing in motion. It is more time-consuming, cumbersome, and expensive. But it surpasses the fluoroscopic screen in the delicacy of its images and in being an unimpeachable record.

It is best to examine the patient first in a standing position on account of the possible presence of partly-filled cavities or pleuritic effusions. If the Crookes tube be kept in a tall, upright case, it is not only safe from dust or accident, but is always ready for use when the patient is stood before it. A front and a back view of the upper, middle and lower thirds of the lungs may be taken. We should compare like parts of the two sides, and different areas of the same side. We should observe the heart-shadow and the diaphragm-line. We should notice if

any unusual condition exists, such as aneuryism or tumor. For convenience in reference we may tabulate the appearances to be looked for, as in Chart I.

CHART I.—POSSIBLE CONDITIONS TO BE OBSERVED IN PULMONARY SKIASCOPY.

Lungs.	Right Side.	Left Side.
Upper Third.	DECREASED TRANSPARENCY. *Intensity*—Light, dark or black shadows. *Position*—Peripheral or central. *Extent*—General or local. Single or multiple. *Form*—Linear, round, oblong, etc., circumscribed or diffuse. INCREASED TRANSPARENCY. *Intensity*—Bright or light reflex. Position, extent and form are the same as above. MOTION *Elicited*—By breathing. By changing position.	Same as on right side. On the healthier side there may be a general increased transparency
Middle Third.	Same as in upper third. Oftener here than above is seen a black shadow extending from base with upper limit more or less level, but capable of being moved by breathing or change of position.	Same as on right side. Also observe here: HEART-SHADOW, AT BASE. Its visibility. Its position. Its form.
Lower Third.	Same as in middle third. Also observe here: DIAPHRAGM-LINE. Its visibility. Its position. Its form. Its motion. In ordinary respiration. In forced respiration.	Same as on right side. Also observe here HEART-SHADOW. Its visibility. Its position. Its form. PERICARDIAL SPACE. Its visibility between apex and diaphragm during forced respiration. DIAPHRAGM-LINE. Compensatory changes on the healthier side.

A familiarity with the fluoroscopic appearance of the lungs in health is an unqualified necessity to the examiner. With the fluoroscope, practice makes perfect; precisely as in auscultation and percussion; or with the microscope and the ophthalmoscope. The eye should be refreshed by a frequent view of healthy structures, and it is a good plan to have within reach some obliging friend or confrère who, at the time of examination, will lend himself as a constant for comparison.

* * * *

The examination of the lungs by the *x*-rays should by preference be done in the evening. Pulmonary skiascopy in the daytime is not a success unless the room can be made absolutely dark. Curtains and blinds are rarely sufficient. It is surprising how great a difference a little daylight makes in such an examination, considering that the fluoroscope is in itself a miniature dark-room. It is the sensitiveness of the retina which is the real consideration. If for any reason the examination must be made in the daytime, the physician should first rest his eyes in the darkness. Fifteen minutes is not too long a time; indeed it may often be insufficient for the best results.

* * * *

In disease the fluoroscopic chest-picture is changed. Shadows of varying density may appear; abnormally clear areas may develop; the heart-line or diaphragm-line may become displaced, obscure, or invisible; and the motion of the diaphragm may be restricted or reduced to zero. These appearances must be interpreted in any given case to mean infiltration, consolidation, cavity, effusion, infarct, etc.; and these conditions must be combined and interpreted to mean tuberculosis, pneumonia, pleurisy, edema, etc. The ultimate factors of a fluoroscopic examination, then, are extremely simple; light, shadow, and motion. Upon these three rests the most elaborate examination by the *x*-rays.

This should give us an increased respect for the diagnostic resources which lie in the fingers, eyes and ears of the humblest practitioner. Simple inspection, palpation, percussion and auscultation open to the examiner a range of signs and symptoms which the *x*-ray cannot equal. But such is the supremacy of the eye, and such the importance of things seen, that even after a careful physical examination, the skiascopic image comes like a revelation.

As we reduce fractions to a common denominator, we may reduce light and shadow to the common terms, increased transparency and decreased transparency.

Either increased or decreased transparency may differ in intensity, position, form, and extent. The third factor, motion, may likewise differ in character and extent and in the method by which it is elicited. (See Charts II and III.)

CHART II.

Lung and pleural sac.	Increased transparency	General	Bright or light reflex	Pneumothorax. Emphysema. Compensatory emphysema.
		Local	Bright or light reflex	Empty cavities. Pneumothorax. Bronchiectasis.
	Decreased transparency	General	Light shadow	Generalized pleura. Congestion.
			Dark shadow	Edema. Cirrhosis.
			Black shadow	Effusion to apex. Total consolidation.
		Local	Light shadow	Infiltration. Thickened pleura. Atelectasis.
			Dark shadow	Partial consolidation. Small filled cavities. Pleuritic exudates. Small tumors. Infarcts.
			Black shadow	Consolidation. Pleuritic effusions. Gangrene. Large filled abscess. Large tumor. Large hydatid cyst.
	Motion	General	Changes in density	During respiration.
		Local	Changes in form	Of half-filled cavities. Line of thickened pleura. Effusions.

CHART III.

Diaphragm.	Visibility	Increased			Inspiration. Emphysema. Pneumothorax.
		Decreased			Expiration. Edema. Congestion of the lower lobe. Consolidation of lower lobe. Thickened pleura at base. Pleuritic effusion or exudate.
	Position	Low			Emphysema. Asthma.
		High			Cirrhosis. Tuberculosis, etc., etc.
		Difference of the two sides.			
	Form	Arched			When high.
		Flat			When low.
		Irregular			In diaphragmatic hernia. Hepatic abscess beneath diaphragm.
		Difference of the two sides.			
	Motion	Ordinary respiration	General range	Restricted	Tuberculosis. Pleurisy.
				Exaggerated	Compensatory emphysema.
		Forced respiration	General range	Restricted	Tuberculosis. Pleurisy.
				Exaggerated	Compensatory emphysema.
			Upper half	Restricted	Emphysema. Asthma. Pleurisy.
				Exaggerated	Compensatory emphysema.
			Lower half	Restricted	Tuberculosis. Pleurisy.
				Exaggerated	Compensatory emphysema.

When we apply these qualifying factors to the interpretation of chest-images the problem of our 3 simple factors, like the problem of 3 bodies in astronomy, becomes less simple. Their interpretation requires experience. However, a good medical education combined with a general acquaintance with the *x*-ray examination, will enable the average man to predict with reasonable certainty what may be found on the skiagraph in any given pulmonary disease. In those diseases in which there is an increased amount of air in the lungs on one or both sides, we would expect to find with the fluoroscope an increased transparency of one or both lungs. This is discovered to be a fact in asthma and emphysema. In those diseases in which there is a diminished quantity of air in the lungs we would expect to find under the *x*-ray a diminished transparency. This we find to be true in congestion, pneumonia, tuberculosis, and many other diseases. Focal diseases, such as abscesses, infarcts, and tumors, would be expected to cast shadows comparable to their size and density.

It is the density of a focus which determines the density of the shadow. There must be more substance in the path of the ray if there would be decreased transparency. Lack of air alone in the lungs would not account for this decreased transparency during expiration. The settling together of the lung-tissue in expiration contributes something to lung-density, but, as Williams suggests, there must also be an increased quantity of blood and lymph in the lungs to account for the change mentioned. Likewise in any point of inflammation there is an increased blood-supply. The tissues may be soaked with serum and infiltrated with leukocytes. The air-cells even may be filled with exudate, and thus the density of a part is increased, and its transparency under the *x*-rays decreased. A substance may be transparent to ordinary light and cast shadows under the *x*-rays. Glass and water are examples. Density, with the *x*-ray, is the criterion. Clear serous effusions cast black shadows on the fluoroscopic screen.

* * * *

The essential idea is the obscuration of one shadow by another, which is superimposed. Experiments may be made with daylight or gaslight, and are simpler to describe than *x*-ray experiments. A piece of ground-glass may be used in imitation of the fluoroscopic screen. Shadows vary in density with the transparency of the object held before the ground-glass. If a piece of paraffin-paper be folded so that it will present from 1 to 32 or more layers, and be interposed between the light and the ground-glass screen, the 32 layers will, of course, cast a heavier shadow than the 1 layer. But these are partial shadows; that is to say, they do not entirely cut off the light. If now some such object as a knitting needle, which will cut off the light completely, and thus cast an absolute shadow, be placed between the light and the paraffin-paper, it will throw its shadow upon the screen through all the partial shadows. But this absolute shadow is seen most distinctly across the shadow of one layer of paraffin-paper, and least distinctly across the shadows of the many layers. If now we substitute in the place of the metallic rod some translucent substance, such as a strip of paraffin-paper, we find that its partial shadow, while it reënforces the partial shadows of the few layers, becomes indistinct and undiscernible across a sufficient number of layers.

It may be stated as a principle that when a weak partial shadow is superimposed upon successively stronger shadows, it becomes less and less definable, until to the eye it is obliterated. At first it is reënforced at the same time that its limits become less defined, but this reënforcement is less and less observable as the opposing shadow becomes denser.

This principle explains why it is so difficult to see a hip-joint or to secure a clear skiagraph of one. The shadows of dense tissues are superimposed upon the shadows

of the bones, which thus are often nearly obliterated.

In applying this principle to *x*-ray examinations of the chest we find that there is

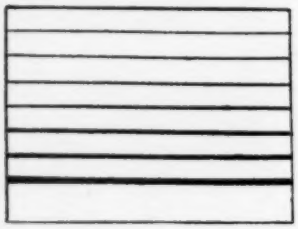

FIG. 5.

FIG. 6.

no essential difference in the behavior of the shadows. The *x*-rays differ from light in that they suffer no refraction, reflection or diffraction that is appreciable. They are therefore singularly favorable to this method of shadow-mensuration.

A number of different instruments were made and tried. The instrument which I first constructed to apply this principle to *x*-ray examinations of the lungs was made by stretching wires, ranging from No. 36 to 8, over a piece of stiff pasteboard 8 by 12 inches. This device was held against the patient on the side opposite the fluoroscope so that the shadows of the wires were cast through the chest upon the fluorescent screen. Over the heart, spinal column, and liver, the finer wires were obscured, but the obvious fault of the instrument was its lack of delicacy. The smallest wire could be seen through a partial consolidation. (See Fig. 5.)

The next experiments were with tinfoil. A piece of tinfoil was folded as was the paraffin-paper so as to give 1, 2, 4, 8, 16 layers. This was gummed upon a stiff pasteboard and placed as was the wire-grating, so that its shadows were cast through the chest. This gave a series of partial shadows. The shadow of one layer was easily obscured. It was easier to see it during inspiration than during respiration. But the unbroken square of shadows secured the field of view. (See Fig. 6.) So I modified the form by leaving spaces between the strips, and after many trials and still further modifications, constructed the instrument as follows: Upon heavy pasteboard backed with cloth, I fastened 6 strips of tinfoil with regular spaces between the strips. Each strip and each interspace was made 1 cm. in width and 25 cm. in length. The first strip was of 1 layer of tinfoil, the second of 2 layers, and so on, until 5 strips were formed.

Thus I had a grating made up of 5 bars and 4 interspaces. A single strip was then fastened one interspace below the bar of 5 strips, to facilitate comparison; and a metallic rod was fastened one interspace below this single strip. One end of each bar was then notched and wire figures were placed in the interspaces. After using the instrument in this form for several weeks it was found desirable to cut holes in the bars so as to give additional delicacy of

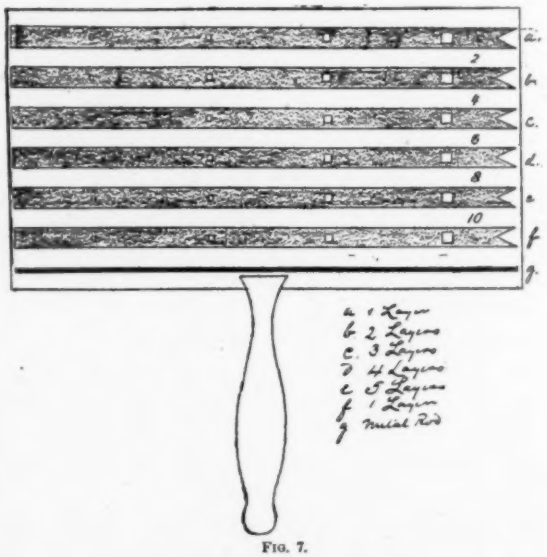

FIG. 7.

observation. A hole cut in a strip of tinfoil becomes obscured more easily than the whole strip, and a small hole obscures more easily than a large one. Therefore, I cut

in each bar a series of 4 holes ranging in size from 1 to 4 mm. square. The final form of this instrument is shown in Fig. 7. Over the face of it may be glued a layer of thin cloth, which saves it from injury as it is passed over the surface of the body, but does not appreciably obstruct the rays.

When this instrument is allowed to cast its shadows through the thorax, there results a series of partial shadows of graduated density. If the shadow of the single strip be taken as one degree, then the smallest hole in the single strip may be taken as 0.2 of a degree, the next hole 0.4 of a degree, the third 0.6 of a degree, and the fourth 0.8 of a degree. This gives us a scale for comparison, and for the record of results.

Inasmuch as this instrument is made and used to measure shadows, it may be called a skiameter.

An idea as to its use has already been given. To illustrate specifically: A patient is placed standing with his back to the Crookes tube. The fluoroscope is held by the right hand against the chest, and the skiameter is held by the left hand against the back. The shadows of the skiametric grating are cast through the thorax upon the fluorescent screen. They are superimposed upon the chest shadows. The skiameter should be held so that its long, narrow shadows run across the shadows of the ribs. If over any given area the examiner finds that the shadow of the single strip has been obliterated, he has encountered a chest-shadow of one degree. If the first 3 bars are obliterated, then the pulmonary shadow is one of three degrees. If the second bar can be made out, but only the largest hole in it can be distinguished, then we have a pulmonary shadow of 1.8 degrees.

It is obvious, other things being equal, that the ability of any given examiner to distinguish the shadows of the skiameter will depend upon the sharpness of his vision. The results obtained by different observers, therefore, would vary. This difficulty may be overcome practically by the use of different grades of tinfoil, and by changing the size of the holes along the bars. Each skiascopist should make his own skiameter. It is simple. There are 3 grades of tinfoil, the ordinary, the tobacco, and the pure tinfoil.[2] He should select a grade of foil such that the shadow of a single strip will be barely but plainly discernible just above the diaphragm during inspiration, through a heavy man's chest of 9 inches thickness. Then he should cut 4 square holes equidistant along the bars, of such size that the second largest in the single strip can barely be distinguished under the conditions just mentioned. It should then be seen during inspiration, but not in expiration.

* * * *

The skiameter is essentially an adjunct to the fluoroscope, but it can be used with the dry-plate. It should be placed in the same relative position to the plate as to the screen. The dry-plate is more sensitive than the eye, and the skiametric values on the plate are consequently smaller than on the screen. A shadow of 2° on the screen may be a shadow of 6° on the negative. That is to say, whereas the first 2 bars of the skiameter may be obscured on the screen to the eye, both bars and the two larger holes in the single layer may appear in the skiagraph. This is for the same reason that the hip-joint, or often a shoulder, on account of the superimposed shadows of the surrounding tissue, may be indistinct or obscured in the fluoroscope and yet show up in the negative.

The standardizing of the skiameter, as already suggested, would make its record on the negative useless for comparison with other negatives. The principle of the skiameter is applicable to skiagraphy, but without those modifications which were necessary for its use with the fluoroscope when we had to deal with that variable factor, the visual acuity of the examiner. In skiagraphy we must have a standard scale of densities for the skiametric shad-

[2] Ordinary foil varies from 2,500 to 2,800 square inches to the pound. Tobacco-foil varies from 1,800 to 2,000 square inches to the pound. Pure tinfoil varies from 6,000 to 7,000 square inches to the pound.

ows, if we use skiametry at all with the dry-plate. The thinnest tinfoil casts too dense a shadow. If a uniform thickness of aluminum foil could be manufactured, we would have a suitable material for this purpose.

The standard skiameter should be constructed similarly to the fluoroscopic skiameter. The shadow of its first bar should be of such a density that its second largest hole may show in the negative when the plate is exposed during inspiration, but be obscured when the plate is exposed during expiration. The scale for linear measurements may be omitted from the standard skiameter. A series of healthy subjects with antero-posterior chest-diameters of about 9 inches should be skiagraphed until the desired standard is obtained. My own facilities are at present insufficient for this work.

Linear measurements may of course be more accurately obtained from the skiagraph than from the fluoroscopic screen. In the case of cavities, an exposure from each side, front and back, should be made to provide the necessary data for calculation.

The method of making fluoroscopic records is of some importance. Rather than write them at length in a case-book, it is better to use either the graphic or the tabular form. For the graphic method, Keen's clinical charts are a great convenience. Both a front and a back view may be represented. The area of infiltration, consolidation or effusion, may be shaded by a leadpencil to correspond to the shadow as seen in the fluoroscope. The skiametric degrees may be marked in ink on the figure. Cavities may be drawn in, shaded proportionately, and marked with the dimensions. If, for example, a cavity is found to be 2 cm. wide by 3 cm. long, and is calculated to lie 6 cm. from the anterior chest-wall, we may mark it thus 2 x 3—6. This may be done on the margin and a line drawn into the figure to indicate the location.

The range of diaphragm-motion may likewise be marked on the margin and a line drawn from the figures to the diaphragm-shadow. If, on the other side of the subject, the diaphragm moves 2 cm. in ordinary respiration, and 5 cm. in forced respiration, then we may conveniently indicate it, thus, 2—5.

On the face of the chart are spaces for the data, diagnosis, and name. On the back of the chart we may mark:

Exciting apparatus.	Apparent distances.....
Vacuum of tube....	Cavity.....
	Diaphragm:
Ant. Post. diam....	Right———O. R.———P. R.——
Distance from tube.	Left ———O. R.———P. R.——

The chart may now be gummed by one edge in the case-book or on the record-sheet.

* * * *

In any series of pulmonary cases examined by the roentgen rays, it will be seen that the differential diagnosis lies between different physical conditions rather than between different diseases. In only a few such cases as diaphragmatic hernia or aortic aneurysm can we make a direct diagnosis. If we find a shadow at the base of the lung, the question which arises is whether or not it is an effusion or a consolidation of a lower lobe, rather than whether or not it is tuberculosis or pneumonia. A radical statement which is probably true is that the diagnosis of tuberculosis should no longer rest on physical signs. Tubercle-bacilli in the sputum and the tuberculin-reaction are practically infallible indications. On one of these should depend the general diagnosis. Then the function of the physical examination, of which skiascopy is a part, can be seen clearly to be an estimation of the extent, form, and location of the involvement. Upon these must rest the prognosis and the special indications for treatment.

Differential diagnosis in skiascopy is a matter of reflex, shadow, and motion. A bright reflex indicates a large, empty cavity or a large pneumothorax. If it is a cavity, the bright reflex may be centrally located and wholly surrounded by a dark or black shadow, or it may be peripherally located

CHART V.—SKIASCOPIC SIGNS IN PULMONARY AND PLEURAL DISEASES.

(The side diseased is referred to, unless otherwise specified.)

Disease.	Lung.	Pleural Sac.	Diaphragm.
Chronic ulcerative tuberculosis.	Beginning:—Light shadow in apex.		Ordinary respiration restricted.
	Well developed:—Dark or black shadow over whole or part of lung. Base of lung generally clear on the site of a light shadow. Lower third may become more transparent on forced inspiration. No change usual in area of dark shadow. Light areas or spots may be present in the midst of the dark or black shadow. The smaller areas may be circular, and surrounded by darker rings. Others may be irregular and ill-defined. Spots darker than the main shadow may be present. When the patient lies down the light areas and spots may disappear, or the dark spot may become a light spot.	A dark line may mark the outline of the lung, especially on the mesial border. A dark spot may be seen from the front and not from the back or vice versa. A black shadow may extend from the base with the upper limit level and defined, but capable of being shifted.	Visibility impaired or destroyed. Position high. Form arched. Motion in ordinary and forced respiration more or less restricted according to severity of the case. Often no movement even on forced respiration. On the unaffected side there is generally a compensatory increase in the range of motion, with a lowered position and a flattened form.
	Advanced:—Shadows darker, and base generally involved. Whole of apex may be a very light area.	The whole side may be a black shadow of even density, or it may be as above.	In advanced cases the diaphragm may be invisible, or it may be faintly defined, high, arched, and motionless.
	Upper half may be mottled with areas of black shadows and spots of increased transparency. No change produced on respiration.		
Lobar pneumonia.	Stage of engorgement:—Light shadow in the affected area.	A dark shadow may extend from base as in chronic ulcerative tuberculosis.	Visibility impaired as a rule. Position normal. Form normal. Motion limited.
	Stage of hepatization:—Dark shadow in affected area which may be sharply limited by the boundary of the lobe.	Same as above.	Motion little, or none.
	Stage of resolution:—Shadows become lighter.		Motion returns.
	Apex, migratory, massive or central pneumonia differ only in the location and extent of the shadow.		
Broncho-pneumonia	Both sides are affected. Diminished clearness of the heart-line. A delicate tracery of light shadows becomes closer and darker towards the roots of the lungs. Occasionally there is a black shadow appearing as in double pneumonia.	.....	Visibility impaired. Position normal. Form normal. Motion diminished.
Chronic interstitial pneumonia. Cirrhosis of the lung. Fibroid phthisis.*	Diffuse form:—Dark circumscribed shadow springing from the mesial side and surrounded by a margin of increased transparency. The more advanced cirrhosis the wider this margin of transparency becomes. Throughout the dark shadow there may be light areas due to cavity or brochiectasis. The heart is displaced towards the cirrhotic lung.	Outline of lung may be marked by a dark line, and if the lung be much contracted the general effect may be that of a ringed cavity, excepting for the increased transparency surrounding. If adhesions exist the outline of the lung may be more or less scalloped.	Visibility. Position very high. Form sharply arched. Motion limited. On opposite side a compensatory emphysema may be present.
	Local form:—Slight or dark shadow usually in the upper third.	.....	Motion limited while disease is active, but increased after disease has become quiescent.
Infarct.	Dark spot or spots generally found towards the periphery of the lung. They are cone-shaped with the points towards the pulmonary hilum.	.....	Motion at first restricted, later increased.
EMPHYSEMA: Compensatory.	Increased transparency on one side, with abnormal clearness of the heart line.	.....	Visibility increased. Position low. Form flattened. Motion increased.
Hypertrophic.	Increased transparency on both sides, with abnormal clearness of the heart-line, vertebræ, and ribs at back. Costal cartilages are calcified and cast shadows. The intercostal spaces are widened.	.....	Visibility increased. Position very low. Form flat. Motion restricted on upper half of each side. Wide space between heart and diaphragm.
Atrophic.	Increased transparency on both sides, with abnormal clearness of the heart-line, vertebræ, and ribs. The intercostal spaces are narrowed.	.....	Visibility increased. Position normal or high. Form normal or arched. Motion restricted.
Interstitial.	Spots of increased transparency at the periphery of the lungs, and less often in other parts of the thorax.	.....	Visibility normal or increased. Position normal or low. Form normal or flat. Motion normal or restricted.
Edema. Congestion. In heart disease, Bright's disease and adynamic states.	The whole lung is the seat of a light or dark shadow. The heart-shadow is indistinct or effaced. Comparison is to be made between the heart-shadow and the shadow of the lung.	.....	Visibility impaired or destroyed. Position. Form. Motion restricted.
Gangrene.	A dark or black shadow, but shading off into a light shadow. The gangrene located generally in the peripheral part of the lower half.	.....	Visibility. Position. Form. Motion.

* In this place may be noted the fact that connective tissue, tendons, cartilage, etc., are more transparent to *x*-rays than muscle, blood, or serum. Although harder, they are less dense. In the roentgen negative of a foot or knee, the tendo achillis and the patellar tendon as well as the cartilage of the knee-joint, illustrate this fact. Therefore a purely sclerotic process in the lung would not presumably of itself produce a very dark skiascopic shadow.

CHART V.—SKIASCOPIC SIGNS IN PULMONARY AND PLEURAL DISEASES—*Continued.*

Disease.	Lung.	Pleural Sac.	Diaphragm.
Pneumonokoniosis.	A delicate tracer of shadows coincident with the bronchial tree. Occasionally light and dark spots may be found.	.....	Visibility. Position. Form. Motion.
Bronchiectasis.	Oblong areas of decreased transparency lie with long axis coincident to that of bronchi. May be surrounded by abnormal areas of lung. (This differentiates from cavities which lie in the midst of consolidations.)	.....	Visibility. Position. Form. Motion.
Tumors.	Circumscribed single tumor:—A clearly circumscribed shadow in any part of lung. Disseminated metastasis:—Pulmonary areas spotted with small and large shadows.	A black shadow may extend upward from base.	..... Visibility. Position. Form. Motion.
Hydatid cyst.	Dark spots may appear anywhere in the lung, but more frequently near pleural or diaphragmatic margin.		
Acute pleurisy with effusions. Hydrothorax. Empyema.	.....	Black shadow extending from base with upper limit and capable of being altered by change of position. Occasionally the shadow extends to the apex of the lung.	Diaphragm line invariably effaced when patient is in the upright position, but becomes visible when the patient is lying down with the head lowered.
Encysted pleurisy.	.....	Dark spots over any area of the lung.	Position normal. Form normal. Motion restricted. Visibility normal.
Acute dry pleurisy.	.....	.....	Visibility normal. Position normal. Form normal. Motion restricted.
Chronic dry pleurisy.	.....	Dark lines may outline the lungs.	Visibility normal. Position normal. Form normal. Motion small.
Diaphragmatic pleurisy.	.....	.....	Visibility normal. Position normal. Form normal. Motion none.
Pneumothorax.	.....	Pulmonary area will appear lighter than usual. Partial outline of lung may be seen.	Visibility increased. Position low. Form flat. Motion restricted.
Hydro- and pyopneumothorax.	.....	Dark or black shadow extending from base with upper limit level and defined, but capable of being thrown into waves. Above the shadow the lung shows increased transparency. When the patient lies down the whole pulmonary area may be darkened.	Visibility, none except when patient lies with head lowered. Position low. Form flat. Motion restricted.

and only partly surrounded. The limits of a large cavity are never sharply marked unless on the lower side, when partly filled with sputum. If it is a pneumothorax, the bright reflex is peripherally located and usually larger than in the case of cavity. If it exists without the presence of pulmonary shadows, the diagnosis is clear, because cavities are always associated with some consolidation. If, however, consolidation does occur with pneumothorax, the outline of the lung will be observable. A local pneumothorax from bronchial communication with the pleural sac, and from circumscribing adhesions, could not be distinguished from a peripheral cavity, especially if it occurred over the front or back area. Its position, however, front or back, could be determined by observing from which side it could be most plainly seen. The closer any object lies to the fluoroscopic screen the cleaner the image.

A light reflex indicates a small cavity, a large cavity nearly full, a small pneumothorax, a greatly dilated bronchus, or an emphysema. If it be a small cavity, it will lie in the midst of a dark or black shadow, and may be called a light reflex, because it is in contrast with its surroundings. It may be encircled by a narrow ring of dark or black shadow if the walls are calcified. This is a healing process that can occur in a small cavity only. Why the calcareous thickening of a spherical cavity will cast the shadow of a ring is easily seen from Fig. 13. The *x*-rays traverse more substance in passing through the edges of the rim than in passing through the mid-

dle. This difference is the difference between the length of *ab* and *cd*.

* * * *

The diaphragm cannot be disregarded in skiascopy of the lungs. Its visibility, position, form, and motion are functions of the highest importance in estimating the extent and severity of pulmonary disability. It is the vital barometer of the lungs, and may give the first signs of coming clouds above.

Its visibility depends upon the contrast which its heavy shadow makes with the thin shadow of the lung. It is a dome of muscle which rests upon the liver on the right and is visible across the whole extent. On the left it rests upon the stomach and is visible across the outer half, the inner half

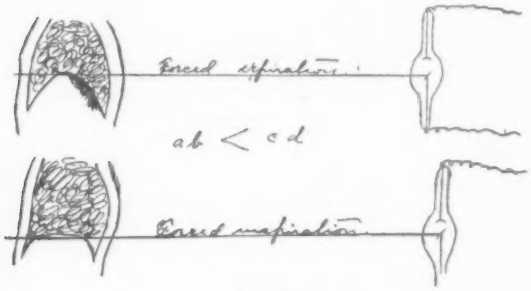

FIG. 15.

being obstructed by the shadow of the heart. In forced inspiration, however, the diaphragm becomes also visible below the heart.[3] The shadow-line of the diaphragm becomes more distinct in forced inspiration because the lungs contain more air and because the diaphragm, being flatter, interposes more tissue in the path of the rays. Conversely, the diaphragm-lines become less distinct in forced expiration, because the lungs contain less air, and because the diaphragmatic dome, being more arched, interposes less tissue in the path of the rays. Fig. 15 illustrates these facts.

The diaphragm becomes very distinct when there is an emphysema or pneumothorax without effusion. But emphysema is either bilateral or else compensatory and attended by disease on the opposite side. On the other hand, pneumothorax would show the shadows of a partially or wholly collapsed lung. The diaphragm may become indistinct in edema, hypostatic congestion, partial consolidation of the lower lobes, or thickened pleura around the base. But in edema there is a general shadow of even density. In congestion, partial consolidation and thickened pleura at the base, the upper areas of the lung may be normal. But these three are not separable on physical grounds alone.

The diaphragm becomes invisible when there is an effusion or a consolidation of the lower lobe. But with effusion the outline of the shadow may be easily shifted, and when the patient is placed upon the examining table with the head lowered, the diaphragm comes into view. If the entire lung is consolidated or if the effusion reaches to the apex, the conditions may be distinguishable without the use of the hypodermatic needle.

The position of the diaphragm in health is variable. The mean in the ordinary respiration is, for the right side, the lower border of the fifth rib, and, for the left side, the upper border of the sixth rib. The left side is normally about 1½ cm. lower than the right. In disease of one side this difference is exaggerated. If the right lung is affected by tuberculosis, the diaphragm on that side will be higher than usual, while on the left it will be lower than usual, on account of the compensatory changes. In emphysema the diaphragm lies very low, in cirrhosis very high.

* * * *

Another ethical point should be considered; this is the duty of the physician to make the most careful possible examination of even an apparently hopeless case. It may be objected that it is useless to examine consumptives in any such detail as has been described in this paper. This objection may be met from several directions. An early detection of a pulmonary involvement, a conscientious prognosis, and an accurate conception of the diseased

[3] The pericardial space between the heart and the diaphragm is formed in forced inspiration when the diaphragm pulls down the pericardial sac while the attachments at the base hold up the heart. The presence of the pericardial space may be taken as a positive sign that no pericardial effusion exists.

conditions present are sufficient reasons. The first is especially important because consumption is not in the earlier stages a hopeless disease. The second is decisive in settling the question of a climatic change. And the third is necessary in planning a rational course of treatment. The growing perfection of the means by which may be located and defined the conditions within the thorax, turns the attention irresistibly to some form of local treatment. But if no immediate practical result could be discerned, the same painstaking examination would be justifiable. A patient has a right to demand of a physician his best efforts. The study of diseased processes, and the cultivation of the power to recognize pathologic conditions are eminently worthy ends in themselves. They must precede scientific treatment, and are the necessary factors of a general professional advancement.

After taking a general survey of the field of pulmonary skiascopy we may say that the *x*-ray has yielded resources of genuine value in the physical examination of the lungs. It has given the scientist a method of acquiring some new knowledge, and of clearing up certain theoretic and disputed points. It has endowed the profession with a means of making more delicate, more direct, and more accurate observations in particular cases. And it may bring from the world at large a greater measure of confidence and respect for the art of medicine.

CONGENITAL ANOMALIES AND VARIATIONS OF THE BONY SKELETON AS REVEALED BY THE X-RAY*

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A CORRECT interpretation of roentgenograms presupposes not only an accurate knowledge of what is ordinarily accepted as normal, but also of such variations and anomalies as may occur in the development of an individual which are atypical but are not, as far as we know, the result of a pathologic process. It is the purpose of this paper to present a collective review of these changes which have been personally observed or culled from the literature with a view toward demonstrating the aid the roentgen examination may furnish in the diagnosis, prognosis or treatment of these con litions.

It is not intended to include within the scope of this paper such conditions as osteogenesis imperfecta, chondrodystrophy foetalis or achondroplasia. Although congenital changes do occur in these, they are so manifestly dependent on some imperfectly understood intra-uterine disease or faulty biologic or metabolic process that they belong more properly in the realm of pathology. Neither will consideration be given to variations in the development of ossification centers except as these lead to permanent changes in the adult skeleton; for many extraneous factors such as traumatism or intercurrent disease may enter into these as causative agents. Exostoses will be excluded for similar reasons.

The changes to be considered may be divided into three classes. Firstly, those which would classify mainly, as freaks of development where the information obtainable by roentgen examination is of scientific rather than practical value. Secondly, those in which the gross appearance indicates the deformity and in which the *x*-ray is merely used to give accurate information of the bony elements involved, for purposes of correction or modification. And lastly, but most important, that large

*Read at the April, 1916, Meeting of the Chicago Roentgen Society

groups of cases in which the roentgenogram gives conclusive evidence of anomalies which may or may not have been suggested by symptoms or which cause no symptoms, but offer obstacles in differential diagnosis, when accidentally discovered.

Class one includes fetal monstrosities, most of which fortunately are non-viable. The roentgen findings in them are as variable as the monsters themselves. Their diagnosis intra-uterine might be of value in the practice of obstetrics but, unfortunately, few opportunities are given us to demonstrate the aid the *x*-ray can give in this field. We have diagnosed one case of anencephalus in this way.

FIG. 1. CONGENITAL SCOLIOSIS IN A SIX MONTH FETUS, DUE TO ANOMALOUS DEVELOPMENT OF DORSAL SPINE.

On right side first and eighth ribs partially absent, and eleventh and twelfth ribs spring from a single pedicle. Twelfth unusually broad and perforated.

In this class belong also cases of hydro- and microcephalus and tower skull. In the two latter conditions, plates of the skull frequently show premature ossification of the sutures and numerous depressions of the inner table conforming to the convolutions of the brain. Defects of the bony calvarium with meningo- or encephalocele can be shown as fairly regular rounded openings in or near the mid line.

FIG. 2. RUDIMENTARY CERVICAL RIB ON LEFT SIDE, WELL DEFINED CERVICAL RIB ON RIGHT SIDE WITH AN ARTICULATION AT ABOUT ITS CENTER, AND TERMINAL PORTION ARTICULATING WITH FIRST RIB.

Evident absence of bones can be demonstrated graphically. For example, absence of all or part of one or both clavicles and lack of both patellæ have been thus shown and recorded in the literature.

In the second class are included those more or less obvious deformities in which the roentgen findings enable the surgeon or orthopedist to determine the feasibility of operative measures to restore the function or improve the appearance of the part, and likewise indicate the best line of treatment. Most of these deformities occur in the extremities distal to the elbows and knees. The individual changes are too numerous to cite here; in a general way the roent-

FIG. 3. ANKLE JOINT SHOWING AN "OS TRIGONUM."

FIG. 4. KNEE JOINT SHOWING BIPARTITE PATELLA AND SESAMOID IN HAMSTRING TENDON.

genogram reveals an absence of all or part or relative overgrowth of one or more bones, a fusion of two or more of the bones or a relative displacement or anomalous configuration of one or several of the bones. Club hand or foot, poly- or syndactylism are good examples of the deformities referred to.

A less evident causal relationship exists between certain cases of scoliosis and congenital anomalies. We have seen three cases in which half bodies interposed between two normal vertebræ caused marked lateral deviation, and a fourth, in which an asymmetrical development of the third and fourth dorsal, associated with a bifid pedicle of the second rib, resulted in a similar deformity. A marked unilateral overgrowth of a sacralized transverse process of a fifth lumbar in another case of scoliosis pointed strongly towards that as a probable cause. In these cases it is very evident that none of the corrective measures ordinarily employed would have been of much value.

Torticollis may rarely be shown to be associated with some such structural anomaly as cervical rib.

In spina bifida the roentgen ray shows the extent of the bony defect. This information would be of especial value if an attempt were to be made to cover the defect by bone grafts as has been attempted lately.

In congenital dislocation of the hip, the *x*-ray not only makes the diagnosis but determines the size of the acetabulum and extent of development of the head of the femur, both of which factors probably enter into the production of the condition and also into the matter of prognosis and treatment.

Regarding the third class of anomalies a knowledge of them is very essential if errors in roentgen diagnosis are to be avoided.

X-ray examination of the head may reveal variations of suture lines in respect to course, location, or number. Thus a suture frontalis may divide the frontal bone into two parts, or a bifurcation of the lambdoid suture may enclose a separate so called "Wormian" bone. There may be a small separate bone, the epipteric, at the junction of the parietal and sphenoid bones in the temporal region. Arterial grooves may follow unusual paths, and they, as well as diploic vein shadows, may be unduly enlarged without known evidence of disease. Pacchionian bodies may cause deep depressions on the inner table along either

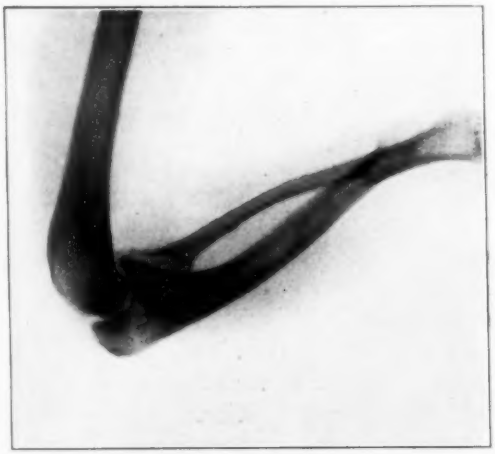

FIG. 5. ANOMALOUS DEVELOPMENT OF ULNA AND RADIUS IN A CASE OF MULTIPLE OSTEOCHONDROMATA.

side of the longitudinal sinus. All of these variations may cause difficulty in the diagnosis of fractures of the bony vault or may simulate disease at times.

The sella is apt to vary as to size and shape, being shallow in some cases and deep in others. The clinoid processes may closely approximate each other almost enclosing the sella. The adjacent sphenoid may extend along its entire floor or even up into the posterior clinoid. Other sinuses also are subject to wide variations in size, location and extent, varying from rudimentary ones to marked overdevelopment or anomalous position. As examples may be mentioned the bulla ethmoidalis, cells in the crista galli or supra-orbital ethmoids. Special attention should be called to the frequency of the asymmetrical arrangement on the two sides as well as to the varying thickness of the wall of the sinuses. This latter has at times led to faulty diagnosis of sinus disease. Few anomalies of bones of the face have been observed. The malar bone may consist of two separate bones. The teeth show frequent variations of positions in the unerupted state; less commonly, one or more are absent or there may be supernumerary ones.

FIG. 6. SESAMOID-LIKE BONES ALONGSIDE OF CONDYLES OF HUMERUS.

FIG. 7. UNUSUALLY LONG TRANSVERSE PROCESS OF SEVENTH CERVICAL VERTEBRA ON RIGHT SIDE.

Cervical rib on left side composed of two parts, terminal portion articulating with first rib.

Examination of the spine reveals numerous variations in regard to number as well as structure. The number is fairly constant above the sacrum, but transition forms are quite frequent in the different regions. Thus the seventh cervical may assume the character of a dorsal vertebra and have attached bi- or unilaterally a completely formed or anomalous or rudimentary rib, which may articulate with the first rib or, rarely, with the sternum. Thus also, the first or even the second lumbar may have ribs attached to them. The fifth lumbar frequently assumes the character of a sacral vertebra, its transverse process being much enlarged on one or both sides, and partly or completely sacralized. In fact, variations of the lumbosacral region are almost as common as so-called normal conditions, and extreme care should be exercised in ascribing pathologic significance to them or misinterpreting them for fracture. One of the anomalies met with here is incomplete fusion of the posterior lamina, a spina bifida occulta. The transverse processes of the vertebræ vary greatly as to

length and outline, and are often asymmetrical. Rarely there may be isolated small bones articulating with the transverse process of the first lumbar, which may simulate renal calculus. Regarding other anomalies, the development of half bodies or asymmetrical variations have already been referred to. The thickness of the different bodies may vary, or rarely two of them may be fused. Variations in number of the sacral and coccygeal vertebræ are not infrequent and transition forms are often present.

Changes in the ribs are frequently met with. In addition to the cervical and lumbar ribs already mentioned, a single rib may articulate by a bifid pedicle with the spine. Two or more of them may be fused for a variable extent. Portions of them may be absent. They may be asymmetrically placed. Their terminal ends may be unusually wide or bifid.

FIG. 8. A CASE OF POLYDACTILISM OF HAND.
Rudimentary thumb lacks all but distal end and epiphysis of metacarpal.

FIG. 9. A CASE OF SYNDACTILISM OF HAND.
Synostosis and lack of development of some of digits.

FIG. 10. A CASE OF SYNDACTILISM OF BOTH HANDS.
Second phalanx of little finger rudimentary.

FIG. 11. MARKED DEFORMITY OF HAND, WRIST AND FOREARM.

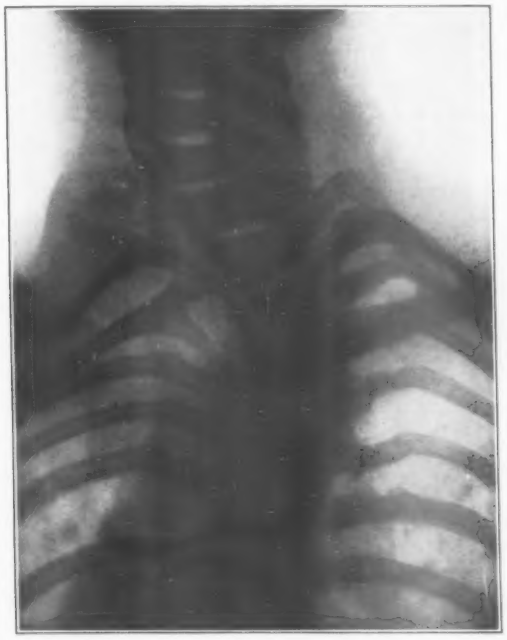

FIG. 12. SCOLIOSIS OF DORSAL SPINE, DUE TO MALDEVELOPMENT OF FOURTH DORSAL VERTEBRA.

Second rib on left side arises from a double pedicle.

FIG. 13. ANGULATION OF DORSAL SPINE, DUE TO INTERPOSITION OF PARTIALLY DEVELOPED VERTEBRA BETWEEN FOURTH AND FIFTH DORSAL VERTEBRA ON LEFT SIDE.

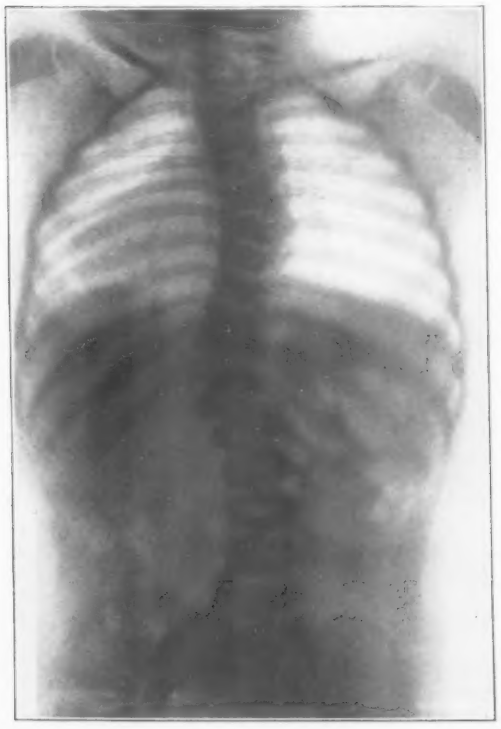

FIG. 14. DOUBLE SCOLIOSIS OF SPINE, DUE TO THE INTERPOSITION OF PARTIALLY DEVELOPED VERTEBRÆ BETWEEN THIRD AND FOURTH AND ELEVENTH AND TWELFTH DORSAL VERTEBRÆ ON LEFT SIDE, AND BETWEEN SIXTH AND SEVENTH DORSAL ON RIGHT SIDE.

FIG. 15. ANGULATION OF LUMBAR SPINE, DUE TO INTERPOSITION OF PARTIALLY DEVELOPED BODY BETWEEN FIRST AND SECOND LUMBAR VERTEBRÆ ON LEFT SIDE.

When a cervical rib is present or the first rib is unusually large, the twelfth is apt to be very small; contrariwise, if the first is small the twelfth is likely to be long. It may articulate with a small separate bone which may resemble bone disease or stone in the kidney. Roentgen examination of the sternum may reveal a fissure of that bone in rare instances. A perforation of its body is a more common occurrence. There may be present at the sternoclavicular junction, supernumerary bones immediately below or above that articulation. A portion of the distal end of the clavicle may be found absent, but this is not to be confused with delayed development. The scapula rarely shows many variations. The acromial end and tip of the coracoid may persist as separate bones, as may also the inferior angle of the blade. In rare instances the coracoid may articulate with the clavicle. The humerus may have, as an anomalous structure, a small spur about two inches above its internal condyle, beneath which the median nerve passes. Its nutrient canal as well as those of other long bones may be much enlarged and cast a shadow on the plate. Albers-Schoenberg has described a case in which numerous increased densities, the so-called "compact islands," appeared in this bone as well as in others without apparent pathologic import. These are comparatively common in the carpal and tarsal bones. The elbow may show extra sesamoid-like bones developing to the sides of the condyles.

FIG. 16. SCOLIOSIS OF LUMBAR SPINE, DUE TO INTERPOSITION OF PARTIALLY DEVELOPED BODY BETWEEN SECOND AND THIRD LUMBAR VERTEBRÆ ON LEFT SIDE.

The bodies of the lumbar vertebræ have undergone some compensatory change of shape.

The wrists and hands show numerous anomalies, mainly in the line of small supernumerary bones located on top of or between the others. Mention may be made of the os triangularis which may closely resemble a fractured styloid of the ulna. Synostosis of two or more of the carpal bones may occur, and some of them, notably the scaphoid and less frequently the os magnum and pisiform, may develop as two separate bones. The unciform process may remain as an isolated structure. There is considerable variation in the number of sesamoids present over the distal ends of the metacarpals. All of these anomalies must be reckoned with in the diagnosis of fracture or foreign body in this region.

Examination of the pelvis reveals comparatively few variations, not already considered. Exceptionally a small separate bone is seen at the upper margin of the acetabulum which may simulate fracture or joint disease. In the knee joint the frequent occurrence of sesamoids in the hamstring tendons must be borne in mind. A rare deformity is a bipartite patella, an example of which will be shown. Very occasionally a separate bone is found in the region of attachment of the patellar ligament. This may be a sesamoid or the isolated remains of part of the upper epiphysis of the tibia.

In the ankle and foot the anomalies found are homologous to those seen in the wrist and hand, namely, supernumerary bones, synostoses and double development. The most common conditions seen are an os

trigonum which may resemble a fractured astragalus, an os peroneum on the other side and an os intermetatarseum between the internal cuneiform and the first and second metatarsals. The sustentaculum may exceptionally develop as a separate bone, and a sesamoid bone consist of two isolated parts.

Before closing, just a few words regarding symmetrical development. In the majority of cases homologous parts are identical, but exceptions are numerous. The latter is especially true of the head and trunk, but differences may be noted in the extremities as well. In all doubtful cases a comparison of the two sides is certainly to be recommended.

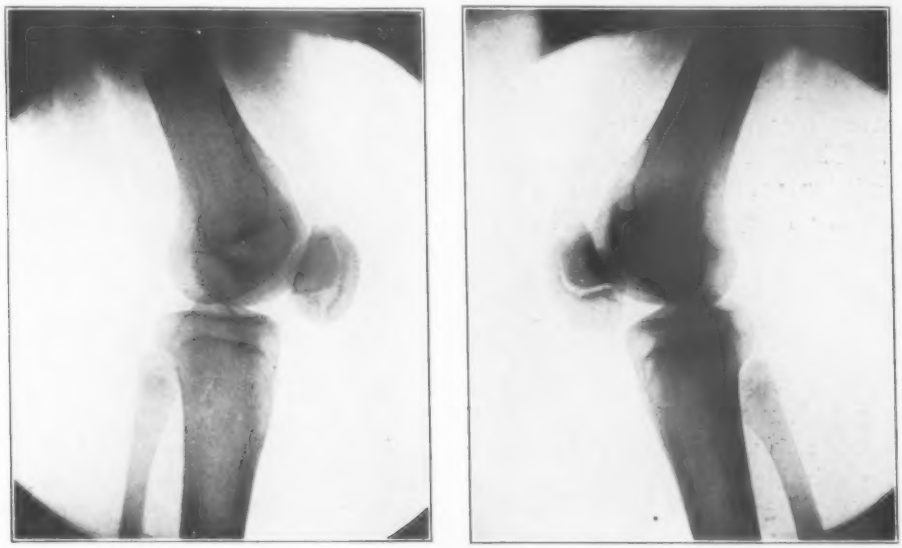

FIG. 17. ANOMALOUS DEVELOPMENT OF BOTH PATELLAS.

For purposes of diagnosis and treatment a distinction must be made between congenital anomalies and variations, and similar changes produced by extra-uterine disease or developmental changes.

The roentgen examination has done practically nothing toward solving the question of etiology of the various congenital variations and anomalies encountered. It has, however, provided accurate representations of them as they involve the bony skeleton in addition to discovering new ones whose presence was unknown previous to its advent. It has permitted of differentiation from similar conditions produced by disease, traumatism or developmental changes and thus rendered material aid in correct diagnosis and treatment. Only a small number of the anomalies and variations have been mentioned. A detailed study of them will more than repay any roentgenologist in interest and points of practical value for the time and energy spent.

IDIOPATHIC INFANTILE OSTEOPSATHYROSIS *

BY EDWARD S. BLAINE, M.D.

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CHICAGO, ILL.

WE find that the term "psathyrosis" is defined as meaning "crumbling, loose, not cohering." The word "osteopsathyrosis" is compounded to indicate "a fragility of the bones." This name is given to a rare bone disease of which comparatively little is known. The term indicates the pathological condition present. Three forms of the disease are recognized: (*a*) fetal osteopsathyrosis (commonly called "osteogenesis imperfecta"), in which the disease is prenatal; (*b*) infantile osteopsathyrosis, in which form the first fractures occur most often between one and one-half and two years of age; (*c*) adult osteopsathyrosis, which develops at a much later period.

A most admirable article on this subject by Kienboeck appeared in a recent issue of *Fortschritte auf dem Gebiete der Roentgenstrahlen*. The monograph is a classic on the subject, and the completeness of the work leaves no angle uncovered. It has prompted the presentation of this paper which includes a report of a similar case seen recently at Cook County Hospital. In his article, Kienboeck reviews the literature on the subject from 1888 to 1914 with 37 citations, to which he adds two cases of his own observation. He states that some authors misdiagnosed their cases in naming them variously "chronic polyarthritis," "osteitis fibrosa," "infantile osteomalacia," "osteogenesis imperfecta," etc. One of his own cases he describes as follows:

"A girl 20 months old. No family history of any similar condition. Normal birth, second child. At nine months of age a fracture without injury occurred in the upper third of the right femur; at 12 months a similar involvement of the left humerus; at 13 months the left femur fractured; at 15 months the right femur, lower third; at 18 months the right humerus upper half; 8 days later the right femur again fractured. The fractures gave but little pain which lasted only for a few days. No evidence of rise in temperature was observed at any time. Clinically all fractures appeared to be well healed with no noticeable deformities. The fractures could not be palpated. No abnormal bowing of the limbs occurred. The child's head showed some evidence of rickets. The blood picture indicated a mild degree of anemia. Wassermann was negative. The child was about normal size and mental development and very lively and talkative.

"*Roentgen Findings.*—The patient was examined during light anesthesia. The *x*-plates show the presence of the previously noted fractures with callous. No fractures are seen to involve the vertebræ, ribs, clavicles, scapulæ, legs, hands or feet. The long bones are seen to be involved in a cortical thinning throughout, as well as being noticeably too slender for their length. Both sides show similar changes. No bowing of the long bones is present. The entire skeleton appears to be involved in a mild degree of osteoporosis. The thinning of the corticalis of the bones is not characteristic of cyst formation such as osteitis fibrosa. Neither is bone tumor indicated, nor are there any signs of inflammatory bone changes. The epiphyses are normal, no indication of rickets or of scurvy being noted. The degree of ossification of the bones indicates the age of the patient.

"The case thus presented the following: Multiple spontaneous fractures of brittle bone which healed rapidly; general bone atrophy with periosteal hypertrophy and osteoporosis; absence of diffuse bone changes

*Read at the Mid-Winter Meeting of Western Roentgenologists, Detroit, Mich., Feb. 5, 1916.

with normal development of the length of the bones and no involvement of the epiphyses. All of which indicate the case to be 'idiopathic infantile osteopsathyrosis.'

"The patient had been seen by the best pediatricians in Vienna and Berlin and incorrectly diagnosed, some giving 'Barlow's disease,' others 'cystic bone,' still others 'infantile osteomalacia.'

"During the months following this examination the patient became progressively worse in spite of the most careful nursing and handling. The spontaneous fractures continued to occur. Phosphorus, thymus, strontium, and calcium preparations failed to improve the child's condition. The case was re-examined 14 months after first seen and the bones found to be far less dense than before with poor healing of the fractures and definite deformities. There was no increase in body weight for a period of nine months. The patient does not complain of pain."

The case recently seen at the Cook County Hospital presented the following: A girl, two years old. The parents speak very little English so that no detailed history could be obtained. The father states that for the past year or so the child has not been well. The patient is the fifth child, none other of the family exhibiting any signs of abnormality; all are well. The patient has had no previous illnesses. A large head with small face has been present since birth. The present complaint is "loss in weight and poor condition." The parents know of no injuries or fractures. The child was apparently normal and healthy until about 12 months of age. Physical examination reveals an emaciated child with marked deformities of the limbs. A large head is noted. There is bulging of the eyeballs. Pupils react to light and accommodation. The thorax has rosary on both sides. A kyphosis is present in the dorsolumbar region. The abdomen is potbellied and tympanitic. Extremities: The limbs appear to be curved to a marked degree. Roughened places felt on the long bones indicate callus at the site of fractures which evidently have been spontaneous. No pain is elicited upon pressure over these points. Wassermann is negative. Roentgen findings: Patient was referred for *x*-ray examination for "rickets." The plates reveal very delicate appearing long bones, a marked osteoporosis being evident. The cortex is thinned out and is barely distinguishable

FIG. 1.—LOWER EXTREMITY.

FIG. 2.—UPPER EXTREMITY.

Showing long bones to be straight, the deformities due to angulation at site of fractures; the ring of absorption at fractures; epiphyses not involved; the very thin cortex throughout entire diaphyses indicating the fragile nature of the bones.

from the medulla. The diameter of the shafts is lessened, but the length is normal. All epiphyses are normal excepting only the wrists where the diaphyseal side has a cup-like convexity toward the epiphysis. Multiple fractures, at least 13, are seen to involve several of the long bones. These are seemingly healed although the callus is not dense as usual, a dark area or band appearing at the ends of the fragments. The long bones are not bent or bowed but several of the fractures have healed in malposition thus causing the deformity of the limb.

Taking into account the clinical picture, the roentgen shadows indicate this to be a case of idiopathic infantile osteopsathyrosis, complicated with rickets. The child was taken with bronchial pneumonia and failed to recover. No post mortem was obtained.

In a typical case of the infantile form of this disease the first sign is a spontaneous fracture of a long bone during the first two years. The fractures result from a very slight fall or slight injury which indicates the brittleness or crumbling nature of the bone. No deformities are present until at a later period. Pain resulting from these fractures is comparatively slight and out of all proportion to such an occurrence. Slight fractures are fissures and may occur without being recognized even on the *x*-plate. In some of the cases reported, joint ankylosis is a feature noted. Bamberg and Huldschinsky give the following classification of fractures in this disease: first, simple fractures and fissures; second, fractures with bending or bowing of the long bones; third, fractures with ankylosis. The latter occur when fractures are near a joint, the first change being spastic but later, after long immobilization, it becomes ankylosed.

Kienboeck states that the earliest changes are exceedingly difficult of recognition and can only be seen upon *x*-ray examination. It consists of a mild degree of osteoporosis. Later on this sub-normal calcification becomes more marked and the thinning of the cortical bone indicates its brittle nature. The first fractures most often occur when the child makes its first attempts to walk, which results in the giving way of the crumbling bone. Due to the inactivity of the patient through fear of further fractures (which, however, occur in spite of care) the porosis becomes worse and a periosteal hypoplasia causes the bones to become very slender.

The fractures are spontaneous and vary in extent from the slightest fissure to a complete break. The *x*-ray often reveals far more fractures than the family knew of, but may not reveal those fractures which heal without deformity. Fissure fractures are exceptionally difficult to detect. These are usually transverse and are the predominating break in the disease. At the site of the fracture there is seen a local absorption of the bone tissue of the fragment ends. This lighter area involves the entire width of the bone, showing that the corticalis is partially absorbed. The less frequent oblique fractures are similarly involved. Kienboeck prefers to call this area or zone an "absorption ring" instead of the earlier term "diastasis." The apparent healing of the fractures is due to the hypertrophy of the periosteal portion of the callus, the cortex lacking calcium salts. In the complete fractures this same condition is present, but to a much greater extent, for which the term "mass absorption" is given. These larger areas of bone absorption permit bending and bowing of the bone, although it is rare to find a pseudo-arthrosis. The lack of calcification of these fractures often permit refracture, a condition which is called "circulus vitiosus."

Looser reported the case of a boy 17 years old, who had about 50 fractures since 1½ years of age whose limb was amputated for excessive bending. The anatomical changes noted were osteoporosis and abnormal thinning of the shaft which was of normal length. Microscopically there was essentially an insufficient and markedly delayed ossification of the bone cells of the osteogenetic layer of the periosteum and a "ring" of defective bone at the apposition

of the fragments. In the latter zone there was an absence of osteoclastic cells.

It is now recognized that the terms "fetal rickets," "rickets annularis" and "osteomalacia congenita" are identical with "osteogenesis imperfecta." The differences between the latter and infantile osteopsathyrosis as given by Kienboeck are seen in Table I.

Infantile osteomalacia is sometimes confused with infantile osteopsathyrosis. The following are points of differentiation, Table II.

Under the heading of pathogenesis, Kienboeck concludes that in idiopathic osteopsathyrosis the bone affection is not a primary bone disease, but is due to a disease of some other organ which is necessary to, or furnishes necessary material to, the normal blood. This probability is also referred to by Hartman, Zezas, Ewald, Bamberg and Huldsinsky. Another hypothesis is that it may be due to a lack of certain nerve elements, a trophic disturbance as it were. But the cause is not known. Careful pathological investigation of sections made of still-

TABLE 1

Finding	Fœtal Osteopsathyrosis (Osteogenesis imperfecta)	Infantile Osteopsathyrosis
Degree of osteoporosis	Moderate	High grade
Location and frequency of fractures	Almost all bones involved; many fractures present	Mostly long bones; most frequently, femur; least frequent, humerus
Kind of fracture	Fissures, slight fractures, transverse fractures; telescoping of bone at fracture	Fissures; transverse and oblique fractures
Length of long bones	Essentially normal but shortened due to telescoping	Normal
Thickness of bones	Increased	With increasing years the bones become very thin and slender
Age	Prenatal	Postnatal

TABLE 2

	Osteopsathyrosis	Osteomalacia
Hereditary	Often	Hardly ever
Sex	Both equally affected	Mostly female
Time of onset	First fracture most often at time of attempts to walk, 1½ to 2 years, but may be later, rarely at beginning of puberty; sometimes congenital	Most often at beginning of puberty but sometimes sooner; never congenital
Noticeable features	Fractures, most often legs, less often arms. Pain for a short time in diaphysis, increase on certain positions and movements. Fissure fractures (no pain).	Gradual onset; almost continuous pain in legs, mostly ends of long bones; pain on pressure over epiphyses and joints
Fractures	Many, may be 24 or more; some fissures. Healing rapid.	Present only in extreme cases. Mostly fissures
Bending of bones, deformities of spine, thorax, pelvis.	Only after the disease has existed for a few years	Mostly knock-knee or bow-legs. Sometimes marked bending
Thickness, length, structure of bones	Long bones are thin; length not disturbed; osteoporosis in later stage; epiphyses normal.	In early stages, delay in growth of diameter and length. Diaphysis and epiphysis equally affected
Ends of long bones, epiphyseal zones	Normal	Marked thickening; rachitic
Ossification	Normal; sometimes advanced	Retarded
General appearance	Good; condition good	Pale, thin, wasting
Duration of disease	May be many years, 2 to 20	Seldom many years
Course	Irregular	Usually regular
Finish	Healing at times before puberty; complications frequent	Usually healing in a few years; marked cases die
Therapy	None	Phosphorus, etc.

born infants with congenitally crumbling or fragile bones has failed to reveal any organic changes in thyroid, thymus, adrenals, hypophysis or pineal gland. Kienboeck offers the name "osteotrophic organ" when it is found. In all cases there is an absence of tuberculosis, syphilis and other of the frequently present diseases.

Regarding the development of the sexual organs no changes have been observed. The testes and ovaries seem to have but little effect on the course of the disease although some cases clear up at puberty, but in others the status is reversed. Observations indicate no complications with myxedema, Basedow's disease or acromegaly, but rickets occurs with osteopsathyrosis at times.

Concerning therapeutical measures, no specific is known. The treatment indicated is probably similar to that of rickets. Phosphorus, thyroidin, thymus extract, pituitarin, etc., are all unavailing.

In the concluding paragraph of his monograph, Kienboeck speaks of the many names that have been given to this disease. Lobstein in 1833 designated the condition as "idiopathic osteopsathyrosis," which is unquestionably the correct term, for it distinctly indicates the pathology. The common term is "fragilitas" and is in quite extensive use as "fragilitas ossium." This, however, merely suggests the particular condition of the bone without other consideration. Vrolik used the term "osteogenesis imperfecta" in speaking of the fetal form of the disease, an unnecessary appellation, and "osteogenesis imperfecta tarda" was the name used by Looser in 1906 in speaking of the adult form; these give an erroneous impression that the infantile and the adult forms of the disease were fetal, which is not the case. Considering the abnormal thinning of the shafts of the long bones, the term "periosteal dysplasia" was given by Schuchardt, and "periosteal dystrophy" by Porak and Durante. "Dysplasia periostalis foetalis" was the term offered by Klebs in place of osteogenesis imperfecta. All these names are misnomers. Incorrect also are the new terms offered by von Recklingshausen "myeloplastic malacia" and "bony hypostatic malacia" because the word malacia is not proper in this disease.

Two more cases of this disease were discovered in the *x*-ray department of Cook County Hospital, but the records have been misplaced. These will be reported at a later date.

ROENTGENOGRAPHIC DIAGNOSIS OF RENAL CALCULUS*

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NEW YORK

WITHIN the last few years, the roentgen ray examination for renal calculi has become perfected, and although well known it may not be amiss even at this period to emphasize its value as an aid in confirming the diagnosis as also the possibility of errors. I therefore quote from a number of irregular cases which have come under my observation. Among these were:

1st, Cases in which the calculi were found on the side opposite to the one suspected.

2nd, Cases in which the symptoms were referred to one side only but calculi were found in both kidneys.

3rd, Cases in which calculi were found in the ureter and not in the kidney as suspected.

4th, Cases in which a short time after an attack of renal colic, the calculus was not in the kidney or ureter, but had passed down into the bladder.

It is perhaps needless to say that before operating on a kidney, it is important to ascertain the condition of the corresponding kidney, and its surrounding structures.

The present improved technic makes it an easy matter to localize a calculus, except in case of pure uric acid and phosphatic stone. These do not cast a shadow on the roentgenogram; but the former rarely occur, and then only in the bladder.

The proper preparation of the patient before examination is very essential, as an error in preparation may often account for errors in diagnosis.

Therefore, about 48 hours before roentgenograms are taken, the patient should take a purge to thoroughly cleanse the colon: one ounce of castor oil upon retiring for two successive nights prior to the day of examination, and an enema the same morning, about four hours before the examination will serve this purpose. The enema should contain ½ to 1 ounce of alum to one quart of warm water. Patient should be without food for 24 hours, and if he will not submit to this, have him on a liquid diet, though mineral waters should be avoided, and the fluid diet should absolutely not include milk which should not be allowed for two days previous to the examination, the object of the above procedure being to lessen resistance to the penetrating rays. If this is not followed out, fecal masses in the colon may appear in the kidney area as irregular black spots, and the shadow cast on the negative will not show the calculi, though present.

Reno-roentgenography to be of value should include the lumbar vertebræ, particularly their transverse processes, the crest of the ilium, the 11th and 12th ribs, the psoas muscle, and of course the outline of the kidney.

POSITION OF PATIENT

In roentgenography of the kidney area, or as I prefer to term it, reno-roentgenography, the patient should lie on his back, head elevated, with the thighs flexed upon the abdomen, firm compression being used, the cone being tilted at two different angles, depending upon the anatomical structure of the individual.

EXPOSURE

The exposure should be made during full expiration as this frees the lower pole of the kidney, thereby giving distinct outline; if possible in one flash while the patient holds his breath at expiration, though

* Read before the Roentgen Ray Association of Greater New York, Feb. 25, 1916, at the New York Academy of Medicine.

it may be made in more flashes at the same breathing point.

My procedure is as follows: First the suspected kidney is taken and then both kidneys on one plate for comparison; this latter is more simple in children than in adults.

If a calculus is localized in the kidney, it is essential to still take a plate from a different angle as this usually shows the outline of the calculus or calculi to better advantage.

After the diagnosis of calculus in the suspected kidney has been made it is sometimes advisable to have the patient return within a week for re-examination. In the meantime the patient should have gone about his usual vocation. If then the shadows are seen in exactly the same area, the diagnosis is confirmed.

After both kidneys are examined, the ureters are radiographed separately and finally the bladder.

DIFFERENTIATION

In reno- or uro-roentgenography special precautions must be used to avoid errors, as many extra urinary bodies may be taken for urinary calculi. They are: 1st, phleboliths in the pelvis; 2nd, calcified plates in the arterial wall; 3rd, calcified lymph nodes; 4th, calcareous glands; 5th, tubercular glands in the mesentery; 6th, calcified portions of costal cartilage; 7th, foreign bodies in the alimentary canal; 8th, biliary calculi; 9th, prostatic calculi; 10th, calcareous cyst of the kidney; 11th, papilloma of the skin in the lumbar region; 12th, appendicular concretions including enteroliths must also be considered.

The presence of bismuth and iron salts taken internally can be eliminated by proper preparation of the patient.

Phleboliths are usually of round or oval shape and their image cannot be obtained outside of the pelvic area.

Calcified lymph nodes, known also as pelvic blotches, are spherical or oval bodies varying in size from $\frac{1}{8}$ to $\frac{1}{4}$ of an inch, but appear as concretions in the pelvic wall.

Calcareous or calcified glands as a rule are multiple. They are usually spherical, with blurred outlines showing irregular calcifications, and the shadow is more dense in some parts than in others.

A gland is nearly always movable and can be easily shown by taking several roentgenograms at various angles with full compression upon the abdomen, thereby displacing it.

A calculus is more typical in shape, pointed, rectangular or oval, of heavier density throughout its entire structure and with a sharp and clearly defined outline. The renal calculus cannot be moved from one position to another.

Biliary calculi being located nearer the ventral than the dorsal wall of the abdomen will show more clearly in the roentgenograms when the plate is placed upon the abdomen, and of course for the same reason renal calculus show more distinctly when it is placed on the back.

In renal calculi the shadows cast on the roentgenogram are of uniform density whereas in biliary calculi the periphery is more dense, but the central portion less so, giving more or less of a ringlike appearance, namely, dense periphery and dark centers.

Furthermore multiple biliary calculi most frequently show facets at the surface of contact, and they usually cast shadows resembling a bunch of grapes, while renal calculi are usually distributed in the kidney, and when united do not show facets.

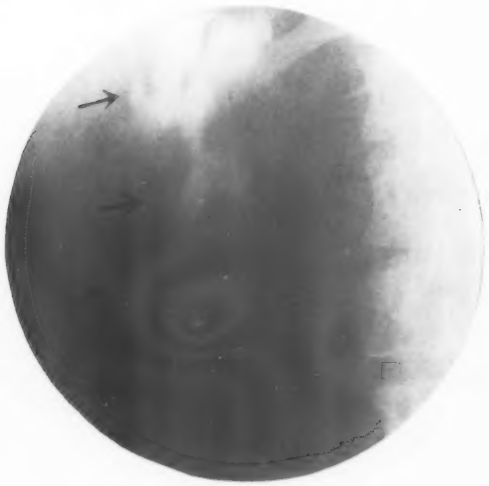
Changing the position of the tube will alter the relation of the biliary calculi to the kidney area, while with renal calculi such changes do not take place and the shadows show always in the kidney area; the latter are also nearer to the spinal column than biliary calculi.

Appendicular concretions appear as small circular vacuoles within the appendix shadow.

When a calculus is suspected in the lower part of the ureter, the above mentioned possible errors must be considered, though in examinations of the right ureter appendicular concretions may be mistaken

for calculi. In doubtful cases, however, roentgenoscopic bougies are helpful in confirming the diagnosis.

In reno- and uro-roentgenography the same as in roentgenography of the thoracic and gastro-intestinal organs, rapid stereo-roentgenography is of value especially in the examination of the bladder. It aids not only in giving length and breadth, but also depth, and its proper relation with the pelvic cavity. By this means we can definitely say whether or not we are dealing with a vesical calculus.



CASE NO. 1.

CASE NO. 2.

In cases presenting gastric symptoms commonly termed dyspepsia, I have found a renal calculus to be present, although no definite symptoms suggesting it were found.

In other patients presenting a dull sense of oppression in the right iliac region, which may be mistaken for appendicular affection, it has frequently proved to be a calculus.

Another class of cases presenting chronic epididymitis of several years' standing, which becomes aggravated on exertion, I have found to have been due to, or at least complicated by, the presence of a calculus, or calculi in the kidney on the same side.

I will present a few illustrations of the above conditions.

CASE NO. 1.—Mr. T. R. referred Dr. Lightstone, Nov. 23, 1913. Symptoms of renal attacks of a few years' duration, referable only to the right kidney. On routine examination a triangular stone was found in the pelvis of the right kidney; calculi were also found in the left kidney of which he did not complain until two weeks after the examination. Diagnosis confirmed at operation on right kidney by Dr. Lightstone.

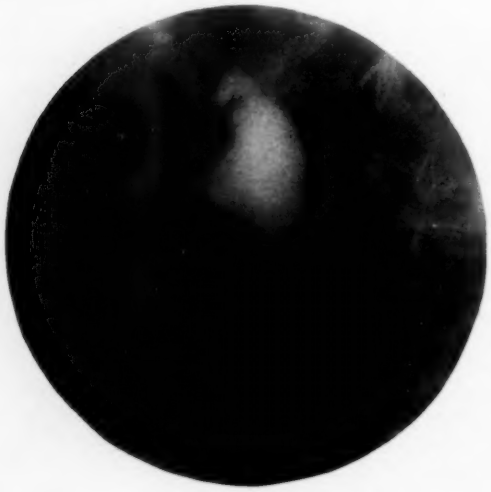
CASE NO. 2.—Mr. A. S. referred by Dr. M. Robbins and Dr. Keyes. Complained of a heavy dragging pain in the right iliac region for nine months, during which time medical means brought no results. On examination, calculus was found in the pelvis on the right kidney, half an inch below the 12th rib.

In such cases it is justifiable in examining the kidney, even if the patient never had an attack of renal colic.

Again other conditions must be considered as bubonocele, gastro-intestinal disturbances, chronic appendicitis, tubercular kidney, and in the female diseased conditions of the tubes, ovaries, and suspected movable kidney.

CASE NO. 3.—Mrs. R. S. Referred by Dr. G. Lichtenstein. Patient had been bedridden for 16 months, complained of attacks of severe pains in the right iliac region, and in the buttocks; never complained of pain on the left side. Upon examination

the right urinary tract was found negative, and a large oval calculus 2 × 1 inches was found in the left kidney. This was confirmed by an operation, Sept. 20, 1914, at St. Luke's Hospital.



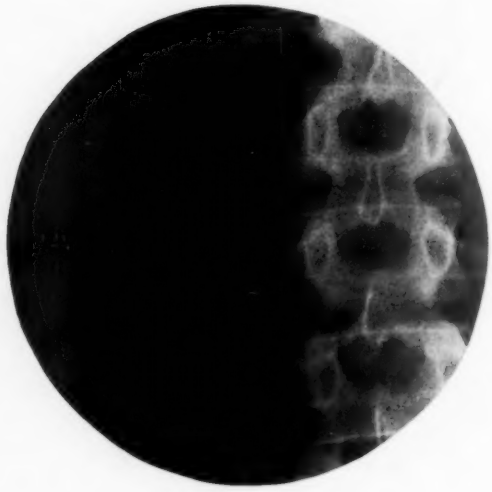
CASE NO. 3.

CASE NO. 4.

CASE NO. 4.—Mrs. B. A. To show proper preparation of the patient. Referred by Dr. John Block, Oct. 21, 1914. Patient had severe attacks of renal colic at irregular intervals. Was roentgenographed on two different occasions with negative results. On routine examination I found two oval shaped calculi ¾ × ½ inches both about the same size, one being situated in the left ureter, and the other partially in the ureter and the bladder. Diagnosis confirmed at operation Nov., 1914, by Dr. E. Beer at Mt. Sinai Hospital.

CASE NO. 5.—Mr. S. B. Diagnosis confirmed at operation by Dr. A. A. Berg. Complained of pain in the left kidney region with gastric attacks. On examination a large calculus was found in the lower pole of the left kidney, and five calcareous glands about that region, though outside of the kidney.

CASE NO. 5.



CASE NO. 6.

NOTE: The difference in density which appears ringlike, denser at circumference

and light in the centre, very much resembled a picture of biliary calculi.

CASE NO. 6.—Mr. C. E., age 34, complained of pains in right hip-joint, tip of coccyx, and at times on urination. Treated in London, Eng., and Boston, Mass., for subacute inflammation of the prostate. Active treatment covering a period of two years.

Dr. J. B. Weighart called in Sept., 1915; suspected calculus in kidney and bladder.

Roentgen diagnosis both kidneys and ureters negative and an old mixed stone situated in the bladder.

CASE NO. 7.—A.

Operated on at Roosevelt Hospital, superpubic, by Dr. Hayden, stone 1¼ inches in diameter removed.

CASE NO. 7.—Mrs. B. G., age 31, native United States. Was perfectly well up to four years ago, when after exposure got severe attack of nausea and vomiting, and pain in the upper gastric region which was only relieved by morphine. These attacks came on every two or three weeks with varying severity until about two years ago, when pain was referred to the descending colon and there was some tenderness over the left kidney. Repeated examination of urine was negative, and there were no urinary symptoms. On Sept. 1, 1915 (Fig. 7, A) roentgenograms showed definite stone in the ureter near pelvis of left kidney and four months later (Fig. 7, B) three examinations showed the calculus 3 inches down in the ureter.

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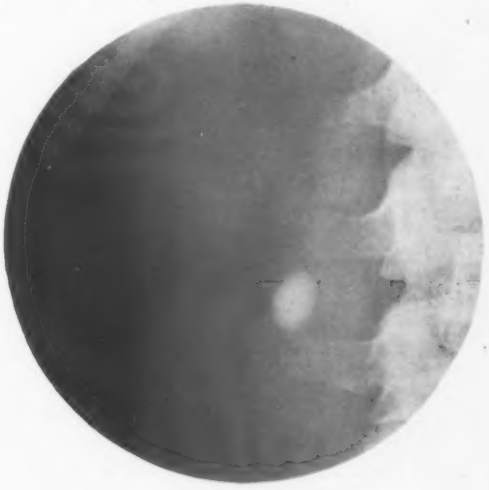

CASE NO. 7.—B.

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EDITORIAL

With the present issue of the Journal, the writer will lay aside the editorial pen and turn it over to his successor. The publication has undergone some changes and many vicissitudes since the AMERICAN QUARTERLY OF ROENTGENOLOGY appeared in October, 1906. It has been a pleasure for the past ten years to watch the development of the publication, and see it change from a quarterly into a monthly.

With the present most prosperous year of the JOURNAL, we feel that the time is fit to have some one else take up the work of management, allowing new methods to be used in the policy of the publication, and to permit the writer to spend the time in other lines which he has devoted to the JOURNAL.

SOCIETY PROCEEDINGS

THE ROENTGENOLOGIST:

MECHANIC OR CONSULTANT?

In closing the first year's work of the Pacific Coast Roentgen Ray Society, I would like to discuss with you briefly, some of the problems which confront us as medical men specializing in roentgenology.

The extraordinary rapid strides of our science in all its phases have created many new conditions, some of which may well tax our capabilities to the utmost to properly meet and overcome.

If our field of endeavor could be limited strictly to medical men, the elimination of many objectionable features would be easily accomplished, but the necessarily spectacular aspect of roentgenology as a whole, and its appeal to laymen with more or less incomplete knowledge of electrophysics has enticed many to commercialize this science on a large scale.

This has given birth to veritable *x*-ray picture galleries where *x*-ray plates are made of everything possible and impossible and at rates that range from a dollar up, and now our country is fairly overrun with men, neither medically nor scientifically qualified to compete with the trained medical roentgenologist, yet supported by members of our own profession because they will grind out pictures at cut rates or at so much per dozen.

Assuming that this statement is correct, there are three main reasons for this deplorable state of affairs. Either the clinician considers himself competent to interpret plates and applies to the lowest mechanical bidder to make same, or he places the *commercial radiographer* upon the same level with the *medical roentgenologist*, or he has not yet fully realized the importance of medical roentgenology nor associated with it the inseparable essentials of a well-balanced knowledge in all the subjects that go into the making of an efficient medical consultant.

In our own city I personally know several colleagues who would rather patronize a lay radiographer than consult with one of his own kind.

This is one problem for which I trust our society can suggest a remedy. It unquestionably behooves us all to conduct our work along lines that are compatible with the highest ideals in medicine and surgery, in order that we may merit the full confidence of our medical confrères.

The present state laws of compensation for injured employees have brought into being a number of insurance companies that are making free use of the *x*-rays for examination purposes. While a few of these companies pay a fairly reasonable price for *x*-ray work, the majority go shopping for cheap *x*-ray men who will do job lot work at a ridiculously low figure. These companies, when they are made to realize that they are not paying for glassware at so much per dozen, but are seeking diagnoses and prognoses and competent medical advice based upon proper *x*-ray studies, may be induced to pay a fee consistent with the value of services rendered. This is another important matter which, it is hoped, our society may be the means of adjusting.

Apropos of this subject there recently walked into my office a distinguished looking person whose card read Dr. ——, Roentgenologist —, Hospital ——. As this hospital was well known, I made haste to meet the gentleman and play the "host gallant." The doctor seemed well-informed upon all matters roentgenologic and spoke fluently of meetings attended and clinics visited in the large centers. After a hearty lunch at my most expensive club, I casually inquired of the doctor as to his alma mater and was both surprised and chagrined to learn that he was not a medical man. He stated frankly that he had been an automobile salesman, had a fair knowledge of photography and through a political friend had secured his present position. It is perhaps needless to say that my interest in this man suddenly ceased and the incident is mentioned only to recall the painful fact that a man of this type is placed upon the same level as you and me, solely because he has learned to make mechanically good *x*-ray plates.

The work of our little society in the short year of its existence has been excellent. The spirit of friendliness and coöperation has been marked and I want to thank you cordially and sincerely for the honor you conferred by electing me your first president. It is perhaps needless to say that I will join hands with you in an effort to maintain the high standard established for our chosen specialty which is destined, and at no distant date, to become a ruling factor in medicine and surgery.

ALBERT SOILAND.

A ROENTGENOLOGIST'S DREAM

ONE of our readers who resides in a small city recently sent in the following contribution, which he said he did not care to sign for obvious reasons. Inasmuch as it touches on a number of points which are of general interest, we departed from our regular rule and allow it to appear.

The first patient presenting himself was a case for stereoscopy of the chest. Fortunately, we had the new type of plate-changer, so that we were able to get a good view of the apices inasmuch as the new type of plate-changer did not cut off part of the detail of the upper portion of the thorax. It was very convenient for us, because we are now able to use the usual plates in envelopes, thus dispensing with the large heavy plate-holders, which required an assistant for their manipulation. We welcomed this new type of plate-changer for chest work because it was something that we have been wishing to own for many years.

Stepping into the closet where the transformer was enclosed, we took a second look at the recently installed device for keeping the discs clean on the collecting wheel. This new automatic dust collecting device certainly was well worth the *moderate* price which we had to pay for its installation, inasmuch as we now get the sharp interruptions which are so characteristic of new machines. The whole affair was so simple we wondered that no one had antedated this progressive manufacturer.

A source of pleasure also was the beautifully balanced shaft which ran without vibration and consequently with practically no noise, even though it was only separated from the waiting room by a very frail partition. This manufacturer followed the lead which had been set by up-to-date automobile companies.

The next case was a Colles' fracture and in making the stereoscopic plates of the wrist, we again found pleasure in the new plate-changer which accommodated the plate-filled envelop without having to crease the envelop or crowd it in by force. When the plate was developed, we missed the usual disfiguring line caused by a wire of improper dimensions on the edge of the plate-holder.

As we stepped up to adjust the tube before the exposure, we made use of the lead shutter in the tube-stand which allowed us to regulate the tube without fogging the plate, so that after our tube was properly regulated, we could make the exposure without having had any previous fogging from the regulation. In detaching the wires from the tube, we again commented on the smoothness with which the reel wound up, even though it had been in use for a number of weeks. The covering of the wire was also such that it allowed a minimum of corona to escape in the darkened room.

The next patient was a case where we made stereoscopic plates of the head. These plates we were able to examine at once, with a considerable expenditure of time, without fear of the films melting, the stereoscope being provided with proper means of ventilation so that we were able to study the plates for a considerable length of time without any ill effects. This, we found, has really improved our reporting system, because we are now able to look at the plates long enough to write a report before the plates are dry. This feature is much appreciated by our clientele, some of whom object to waiting two days for a report.

The next case was a bismuth injection of the colon in a rather fleshy patient, and we were able to use the horizontal fluoroscope for a considerable length of time without fatigue, the height of the table being such that no backache was suffered at the end of even a somewhat protracted observation. In this examination, the long expected and perfected Coolidge tube was used, provided with an efficient diaphragm which cut out the secondary rays

and so obviated many of the old inaccuracies of observation. It is astonishing how much one can really see in the abdomen now that we have tubes which produce a minimum amount of secondary radiation. The performance of the tube was also much helped by a proper system of diaphragms on the fluoroscope, which acted much better than the old-fashioned simple shutter.

In making a survey of the chest, we were much struck by this same feature. Gross lesions were, of course, easily seen, as before, but small areas came out with a detail with which we were formerly strangers.

Our dark-room assistant remarked upon the fact that he was feeling much better these days, since the new system of tanks had been installed. These tanks are provided with mechanical means, actuated by motor, which keep up a constant circulation of developer during the process of development. This prevents the formation of streaks and allows the plate to be fully developed by the factorial system. It certainly seemed very odd, considering the number of tanks formerly used, that no one had ever before put on this attachment.

In making a vertical fluoroscopic examination, we felt somewhat lonesome, as we missed the old familiar tick, tick of the little steel pin in the rubber handle. Our new fluoroscope had a handle entirely protected so that our old static friend was entirely eliminated.

As we have now finished with our office cases, we went out to make a portable examination of a fractured hip. We formerly used to make these examinations with some feelings of uncertainty as to what our results would be. We, however, did not anticipate anything but the best results as the portable machine is equipped with a suitable device for tube regulation and also a light-weight milliammeter, which told us exactly what the electrical conditions of the tube were. Of course, it deprived us of a little fun, as the problem of guessing at the exposure was now at an end.

When we returned to the office, we found that the regular inspector of the Service Department of the ——— Electric Company had been in and had made his regular monthly inspection. The machine was properly oiled, the automatic dust-collecting device was properly adjusted, and the whole equipment was in the very best possible shape. The brushes on the motor had been properly trued up and adjusted so that there was no excessive wear and tear on the commutator. The fee which the inspector charged was paid with pleasure as we felt that it was a great relief to get away from the constant fear of a breakdown.

In considering the last roentgen meeting, we thought how different the atmosphere was than at some of the former meetings. The papers read were not devoted to the self-aggrandizement of the writers, but represented an honest effort to advance the cause of roentgenology. Secondly, the papers that were presented were all new, not having been read at other meetings, and rehashed under slightly different titles. The discussions were also very pointed, and did not consume much time as the Chairman did not allow statements of "I think" and "I believe," but required all the discussors to confine themselves to real facts.

In going over our monthly accounts, when we came to the item of plate bills, we were gratified to notice the monthly saving which has taken place since the introduction of the plates of different sizes, especially devised for roentgenologic work. We figured that we could take an extra week's vacation on the saving that had taken place since the manufacturers of plates became sufficiently interested and progressive enough to furnish roentgenologists with other than landscape sized plates.

Unfortunately here the writer woke up, and found that it was all a dream.

DEPARTMENT OF *LABORATORY NOTES*

EDITOR, *David R. Bowen*, M. D., *Philadelphia, Pa.*

CYLINDER WITH BUCKY EFFECT

SIMPLE TECHNIC TO MAKE FLUOROSCOPIC IMAGES CLEARER

BY CARO W. LIPPMAN, M.D.

SAN FRANCISCO, CAL.

THREE years ago, while doing experimental work with Holzknecht on filling the duodenum by means of a duodenal tube, we used the ordinary Holzknecht spoon to block off the duodenum. Gradually we gave up the use of the tube, merely filling the duodenum by effleurage from the stomach. Bucky of Berlin visited us at this time, showing his "Vordergitterblende." We (Holzknecht and the author) recognized the great value of the principle—the screening off of the secondary rays in the body just as the shutter of the fluoroscope or the Albers-Schonberg compression cylinder shuts off most of secondary radiation of the tube. The "Gitterblende" was, however, awkward to handle, interfered with palpation and freedom of motion. We decided to use a lead cylinder attached to the ordinary Holzknecht spoon handle—as seen in the illustration.

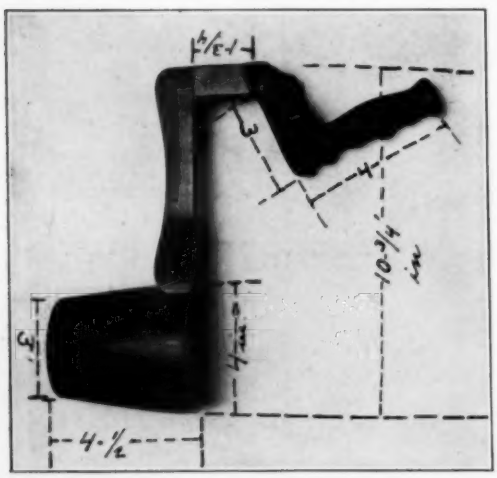

FIG. 1.—MODIFICATION OF HOLZKNECHT SPOON, WITH CYLINDER TO GIVE BUCKY EFFECT.

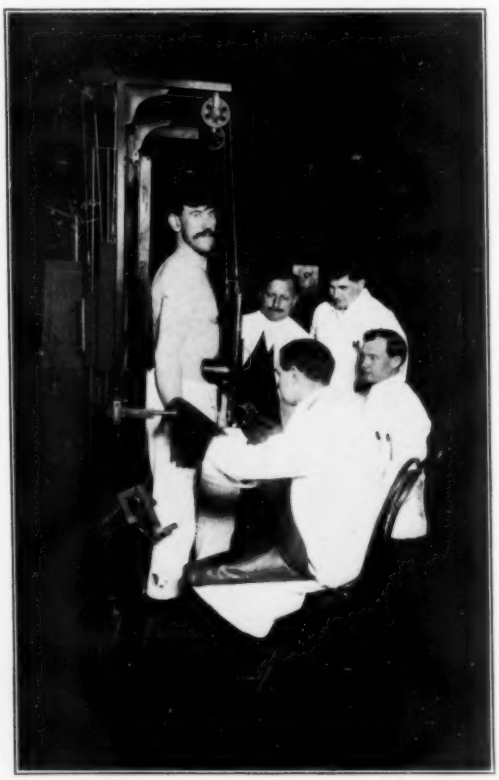

FIG. 2.—EXAMINATION OF THE APPENDIX FLUOROSCOPICALLY WITH BUCKY CYLINDER.

Immediately the fluoroscopic screen be-

came not alone a method of recognizing a piece of bismuth the size of a pea, but the dotted line of a faint appendix shadow or duodenal bulb in a stout person became a plastic picture, such as one saw previously only on plates. This was excessively important in the clinic work in Vienna, where the expenditure was limited. At the San Francisco Hospital, where we drain in from several hundred beds, the same thing holds true—we must give opinions on the duodenal bulb and appendix yet limit the use of plates. The Bucky cylinder with handle helps give us a clear shadow, not alone because it screens off secondary rays from the body, but also because we are able to exert compression with it. While exerting compression, we are able to determine the movability of an appendix or the coincidence of a pain point therewith. Sometimes, I use it as a time-saver. A duodenal bulb is defective; the defect is constant for many minutes: I press the Bucky instrument against the pyloric end of the stomach and by effleurage fill out perfectly an otherwise refractory duodenum. Personally I rarely feel the need of a plate for my bismuth work except when the patient is very stout.

FIG. 3.—ROENTGENOGRAM OF PYLORIC END OF STOMACH AND DUODENUM.

Duodenum being filled by pressure of the cylinder at the duodeno-jejunal flexure.

A POSTURING INSTRUMENT FOR FEET AND LOWER EXTREMITIES

THE device here illustrated by two views, one taken from each side, was first made and still largely used by us as a means of holding both feet "pigeon-toed" in order to bring both hips of a child into position with the neck of the femur, nearly or quite parallel to the plate and both in the same position.

We find it fully as useful, however, in posing the knee or ankle for the antero-posterior exposure. The thumb screws by which the blocks are tightened into place are sold in shops of cabinet makers' supplies as "mirror screws" and have a nut which can be fastened to the block by two screws. Otherwise, the whole device is of wood and easily constructed from the illustrations.

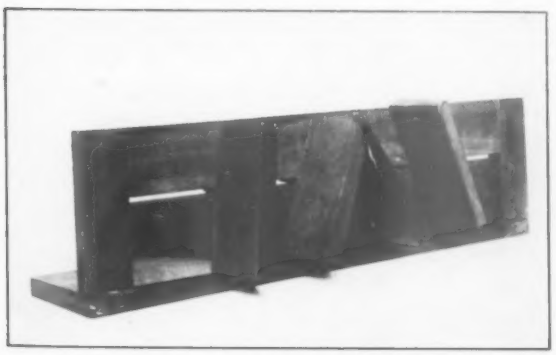

FIG. 1.—POSTURING INSTRUMENT FOR FEET AND LOWER EXTREMITIES. PROXIMAL SIDE.

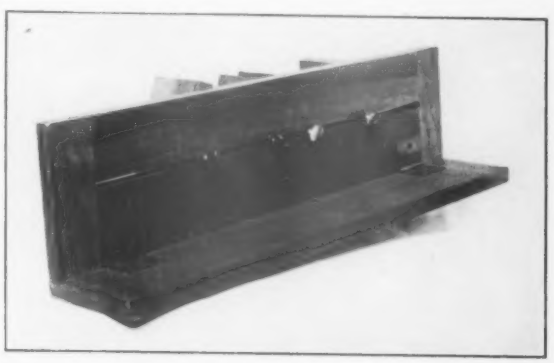

FIG. 2.—POSTURING INSTRUMENT FOR FEET AND LOWER EXTREMITIES. DISTAL SIDE.

DEPARTMENT OF TRANSLATIONS & ABSTRACTS

EDITOR, *James T. Case*, M. D., *Battle Creek, Mich.*

KÜPFERLE and v. SZILLY: Radiotherapy in Hypophyseal Tumors. (*Deutsch. med. Wchnschr.*, 1915, No. 31, p. 910. Ref.: *Zentralbl. f. Roentgenstr.*, Vol. VI, Nos. 9 and 10, 1915.)

Aside from epiphyseal tumors in which the progressive destruction of the power of vision with threatening destruction of the central visual acuity indicate operative procedure, there are cases (cystic and adenomatous tumors) where a waiting attitude is justified or where the central vision is already doomed. For this class of cases radiotherapy is the indicated remedy. The author communicated the case of a patient who, after a successful hypophyseal operation, had completely lost his power of vision by a recurrence of the malignant growth, and recovered almost complete vision after intense *x*-ray treatment continued for a long time.

COTTON, ALBERTUS. The Limitations of the X-Ray in the Diagnosis of Certain Bone and Joint Diseases. (*Am. Journ. Orthop. Surg.*, Vol. XIII, No. 2, Oct. 19, 1915.)

The author describes the usual roentgen findings in bone and joint affections occurring in tuberculosis, infectious osteomyelitis, syphilis, sarcoma and ostitis fibrosa or bone cysts, which do not show the pathological changes distinctly enough to make a diagnosis without the aid of clinical data. The roentgenogram is of limited value in the early diagnosis of synovial tuberculosis, the fuzzy or wooly appearance of the affected joints serving to distinguish them from atrophic arthritis and latent tuberculosis. The early stages of acute infectious osteomyelitis give negative roentgenograms, but after six or eight weeks the findings are characteristic. They are distinguished from syphilitic osteoperiostitis by the limited area of bone destruction (gummata) and the greater periosteal and enosteal involvement resulting in the characteristic periosteal thickening and partial obliteration of the medullary cavity (periosteal syphilis). But inasmuch as the roentgenograms of circumscribed osteomyelitis (Brodie's abscess), bone cysts and giant cell sarcoma are similar in appearance, the clinical findings must be considered before a diagnosis can be made.

Syphilis of the bones is manifested in epiphysitis, gummata and periostitis. Of these, epiphysitis may be mistaken for tuberculosis; gummata for typhoid, sarcoma or localized osteomyelitis. Syphilitic periostitis, however, produces a pathognomonic roentgenogram.

When sarcoma of the bones is fully developed, the roentgenogram is characteristic, but in the early stages it may be mistaken for syphilis, typhoid, tuberculosis or pyogenic infections. The cause for the similarity consists in the fact that, according to the affection, the destroyed bone is replaced by a semi-solid substance, blood-stained fluid or pus which can not be differentiated by the *x*-ray, while the bone defects are not sufficiently characteristic to reveal the character of the disease.

LUEDIN, M. Acute Atony of the Stomach During a Fainting Fit. (*Fortschritte, a. d. Geb. d. Roentgenstr.* XXIII, No. 6, March 2, 1916, p. 503.)

The roentgen examination of a female patient who complained of indefinite gastric pains showed the stomach to be of normal form with normal peristaltic behavior. During the fluoroscopic examination the stomach gave the impression as if it were about to descend. The lower part became dilated but relaxed. The surface remained smooth without showing the slightest peristaltic movements. In the upper, empty part of the stomach, a typical tapering

movement set in. The stomach had lost its peristaltic function.

The further behavior of the stomach could not be observed, as the patient became faint. Her face was covered with cold sweat and the pulse was small and very frequent. I may add that the room temperature was high, that patient was timid and had partaken of the barium meal with great repugnance. These factors may have contributed to the faintness as much as the sudden gastric atony, although it is difficult to decide whether atony was caused by the fainting or fainting by the atony. According to clinical experience, either is possible. Without going into far-fetched hypotheses, I may call attention to an analogous gastric picture which we owe to Klee's experiments upon a decerebrated cat. Klee eliminated the vagus by cold, and the gastric picture was completely dominated by the sympathicus innervation. "Total absence of peristalsis and complete relaxation of the pyloric and median parts of the stomach were the signs of the stomach which was unilaterally influenced by increased sympathetic impulses."

As soon as the vagus function was reinstated by heat, the cat's stomach resumed its normal form and active peristalsis. The same behavior was observed in our patient. After she had recovered from her faintness in about fifteen minutes, roentgenoscopy was resumed. The shape of the stomach was normal again and the peristalsis very active. After four hours, the stomach was empty.

It is not impossible, however, that the sudden atony of the stomach in our patient was caused by a preponderance of the sympathicus excitation, possibly a temporary elimination of the vagus function during the fainting spell.

WEIL, ALFRED. Armored Heart ("Panzerherz") and Pick's Hepatic Cirrhosis. (*Fortschritte auf dem Gebiet der Roentgenstrahlen*, Vol. XXIII, No. 6, March 2, 1916, p. 489.)

Lime deposits in the pericardium occurring in the final stages of inflammatory processes may be fluoroscopically demonstrated and hardly call for short exposures. In the present case, a young soldier, the heart appeared walled in by a lime deposit like a mail-coat. These lime plates, however, do not cover the entire heart, but only the ventricles. The roentgenograms taken in three directions show that there are really extensive planes of lime infiltrations and not isolated lime foci or trabeculæ.

The exposures made in the frontal and transverse directions (Plate XXI, 1 and 2) show the way the anterior and inferior surfaces of the ventricles are encircled by the lime crust, while the sagittal exposure (Fig. 3) illustrates the left cardiac border. The stereoscopic picture is still more distinct.

There is a gap at the apex, into which the heart is seen to be forced. This perhaps accounts for the diastolic scratching which is particularly distinct just at the apex.

Clinically, there were no particular complaints or objective symptoms. But after having served in the army for two weeks, the complaints were severe enough to cause his being sent to the hospital.

Anamnesis.—First complaints three years ago, consisting in increasing dyspnea on exertion and abdominal distention. At that time (1912) examination at the hospital established cardiac dilatation, hepatic swelling and ascites, temporary edema of the legs. After appropriate treatment and rest he was able to perform light work.

Present Condition.—Cardiac impulse in the fifth intercostal space, visible and palpable as a systolic in-drawing. Cardiac dullness extends to right and left. Second sound impure. To the left of the sternum, pericarditic friction, especially toward the apex. Pulsus paradoxus, established by palpation and on curves. Pulse temporary rhythmical, at other times totally arrhythmical. Blood pressure 85 Hg. Liver distinctly enlarged, inferior border indurated, palpable at 4 fingers' width below the costal arch. Spleen palpable. No ascites. No pathological changes in other organs.

On the ground of these clinical symptoms, pericarditic pseudocirrhosis (Pick) may be positively assumed.

Symptoms pointing to the etiology of pericarditis are less obvious. The insidious onset renders it probable that the inflammatory products gradually changed into calcified tissue are of tubercular origin. Other calcifying factors are decreased metabolism, necrobiosis and tissue necrosis and, perhaps, impaired circulation. In pleuritic callosities there is almost never calcification, good vascularization probably preventing degenerative processes and secondary calcification. A peculiar fact consists in

the occurrence of lime deposits in the region of the ventricles, such as occurred in the cases of Groedel, Schwarz and Rieder, while the auricles are not affected. This may also be due to circulatory conditions.

There seems to be no doubt that the calcification of the pericardium has an unfavorable influence upon the circulation by impairing cardiac function and constricting the vessels, and it is probably more than a coincidence that in 4 out of the 6 known cases of calcification of the pericardium, the pathological picture of Pick's hepatic cirrhosis was present. Rieder has already pointed out that the roentgenological findings may contribute to the correct interpretation of this symptom complex. In the present case, for instance, the pathological condition was at first overlooked; later a valvular affection was assumed, until the roentgen examination led to the correct diagnosis.

PFAHLER, GEORGE E. X-Ray Diagnosis of Surgical Complications within the Chest. (*New York Med. Jour.*, Vol. CII, No. 25, June 17, 1916, p. 1160.)

In view of the fact that a roentgen examination is especially adapted to diseases of the chest due to the transparency of the lung and that not only chest diseases but also surgical complications affect that transparency, Pfahler gives a short description of the latter, admitting that an exhaustive description would entail a complete paper for each complication.

In the mediastinum he mentions aneurysm, atheroma and tumors. An unrecognized aneurysm of the aorta may lead to serious trouble, and roentgenoscopy will reveal its presence. While not necessarily contra-indicating an operation, it may influence the surgeon in the choice or administration of the anesthetic and the type of operation. The demonstration of atheroma is important on account of its frequent association with angina and conditions causing sudden death. It is recognized roentgenologically by tortuosity, a sharp projection to the left of the descending arch, calcareous plates and thickening of the aortic walls in the oblique position. The determination of the exact nature and extent of a tumor involving the mediastinum is important in order that the surgical procedure may be better planned for the life of the patient. This refers to sarcoma, lipoma, carcinoma, Hodgkin's disease, thymic enlargement and thoracic goiter, and the author describes the roentgenological pictures presented by each.

Surgical complications involving the lungs are the following: Abscess, gangrene, tumors, bronchiectasis. While an abscess may be suspected from general symptoms, it is important for surgical purposes that it be definitely diagnosed and localized. Both roentgenoscopy and roentgenography in the erect position should be used for this purpose. The same remarks apply to gangrene. Tumors of the lung are generally secondary, and their surgical importance consists in their recognition for the purpose of avoiding extensive operations elsewhere in the body. As bronchiectasis is now treated surgically, the exact situation and extent of the disease must be determined roentgenologically. Stereoscopic examination is found especially valuable.

Pleural complications are more frequently attacked surgically than any other affection in the chest. They consist in effusion, empyema and tumors of the pleural cavity. Effusions are roentgenologically detected in the upright posture. While the presence of empyema may be recognized by physical signs, its location is difficult to determine except by roentgen examination, and its definite location and diagnosis will greatly help the surgeon. Tumors of the pleural cavity are generally secondary, following carcinoma of the breast.

Complications of the larynx, trachea and the bronchi are caused by foreign bodies and tumors. Foreign bodies consisting of wood, fibers, cartilage and all organic materials can not be demonstrated by the roentgen rays except by the secondary changes in the lung tissue. Tumors of the bronchi are very rare, but can be recognized.

The author advocates the early use of the roentgen rays in these diagnoses, as at times they may be the means of deciding between life and death. H. E. A.

STREBEL, J.: Autotrephining in Turricephalus (Steeple Skull) and the Nature of this Cranial Anomaly. (*Korrespondenzbl. f. Schweizer Aerzte*, 1915, No. 17. Ref.: *Zentralbl. f. Roentgenstr.*, Vol. VI, Nos. 9 and 10, 1915.)

This article contains very good roentgenograms of steeple skulls which beautifully re-

produce the roentgenological signs consisting of the "typical faveolate (honey-comb) picture with distinct tracings of the cerebral relief." The author concludes:

(1) In findings of apparently primary atrophy of the ocular nerve, the cranial variety or configuration should be paid increased attention and the examination supplemented by a roentgen examination of the cranium.

(2) The roentgenograms not only of total, but also of partial steeple skulls may often be decisive in the differential diagnosis by reason of the faveolate relief tracings of the cerebral convolutions at the tabula int. (the so-called impressiones digitatæ), together with the often enormous ramification of the canal system of the sinuses. This holds especially good in cases which externally do not cause the impression of turricephalus.

The other statements on the nature and treatment of the symptoms connected with turricephalus are not of any particular roentgenological interest and should be read in the original.

DOBERAUER, GUSTAV: Perinephritic Abscesses. (*Beitr. z. klin. Chir.*, Vol. 95, No. 2, p. 329. Ref.: *Zentralbl. f. Roentgenstr.*, Vol. VI, Nos. 9 and 10, 1915.)

During the last few years, the author has observed twelve cases of perinephritic abscess. The principal symptoms were: Fever, spontaneous pain, pressure pain, dullness in the lumbar region, palpable resistance, occasional visible protrusion.

It is a noteworthy, because hitherto undescribed, fact that the author demonstrated a shadow on the roentgen plate produced by the abscess in all cases but one.

Treatment consisted in broad incision and drainage of the abscess. The author considers it unnecessary and often difficult to expose the kidney, as demanded by Rehn. On the other hand, he considers it very important to palpate the abscess cavity very minutely in order not to overlook any encapsulated secondary cavities.

NISSIM, G.: The Volume of the Heart During and After Exertions. (*Il Lavoro*, 1914, No. 4. Ref.: *Zentralbl. f. Roentgenstr.*, Vol. VI, Nos. 9 and 10, 1915.)

The following are the author's conclusions, as the result of his orthodiagraphic examinations:

In healthy individuals the heart becomes smaller in volume in exertions in direct proportion to its accustomed function and to the labor performed. If in patients with cardiac affections the surface of the heart is reduced, it is in inverse proportion to the heart lesion and is therefore a valuable diagnostic aid in determining the gravity of the cardiac complaint. This diminution is not in relation to the increased intrathoracic pressure, nor to the increased frequency of the pulsation, but rather to the tonicity of the heart fibres. It occurs immediately after the beginning of the exertion and gradually disappears when physical rest is restored.

NYARY, LADISLAUS: A Characteristic Symptom of Subphrenic Gas Abscesses. (*Deutsch. med. Wchnschr.*, 1915, No. 38, p. 1125. Ref.: *Zentralbl. f. Roentgenstr.*, Vol. VI, Nos. 9 and 10, 1915.)

According to the author, a change in the epigastric percussion sound is a new symptom facilitating the diagnosis of a right-sided subphrenic gas abscess, before a roentgen examination is made. The roentgenological findings were as follows: Heart slightly dislocated to the left, the right half of the diaphragm is considerably pushed up, very slight mobility even at deep inspiration. Below the right diaphragm there is an air-filled space, the lower border of which is medially formed by the slightly flattened liver, laterally by a collection of fluid which always assumes a horizontal level when patient changes his position.

SCHWARZ, ERWIN: Migration of Aspirated Foreign Bodies in the Lung. (*Beitr. z. klin. Chir.*, Vol. 95, No. 1, p. 74. Ref.: *Zentral. f. Roentgenstr.*, Vol. VI, Nos. 9 and 10, 1915.)

Case I.—Two years ago, a workman, 23 years old, had "swallowed" a piece of iron while practicing the trick of "swallowing swords." No attempt at its removal was made at the time. Patient was admitted for "catarrh of the lungs," the etiology of which was withheld, but discovered by the *x*-ray. The point of the foreign body was lodged in the angle of the diaphragm by the side of the tenth rib. Uncomplicated removal by thoracotomy and suturing of the non-adherent pleural layers. Bronchopneumonia successfully overcome.

In this case, the foreign body had penetrated

into the right bronchus and finally the lung tissue by gravitation, being arrested only by the resistance encountered.

Case II.—A 10-year old boy had aspirated the tin cap of a lead pencil. The roentgenogram showed the same in the left pulmonary field over the shadow of the heart. Extraction by bronchoscopy failed. Followed edema of the glottis, necessitating tracheotomy. Another fruitless bronchoscopy.

A roentgen examination now showed the foreign body in the right lower bronchus. When another bronchoscopy was made the same day, it had again migrated from right to left, where it was removed without the bronchoscope by means of distending forceps. Cure.

Migration of a foreign body from one bronchus to the other has never before been observed. In this particular case the presence and repeated disappearance of the pulmonary atelectasis was accidentally observed according to whether the foreign body occluded a bronchus or not.

The question whether a metallic foreign body is arrested in the esophagus or trachea and whether it has been swallowed or aspirated, can be positively decided by roentgen examination.

MANGINELLI, L.: Diagnostic and Pathogenetic Significance of the Roentgen Examination in Duodenal Ulcers. (*Policlinico*, Vol. 22, 1915, Nos. 1 and 3. Ref.: *Zentralbl. f. Roentgenstr.*, Vol. VI, Nos. 9 and 10, 1915.)

The author starts from the assumption that a roentgen examination is not sufficient for the diagnosis of duodenal ulcer, but that it supplements the anamnesic and clinical data and, with correct interpretation, elucidates the pathogenesis of the ulcerous symptoms. After a critical survey of the literature, Manginelli reports on twenty closely observed cases, eleven of which were operated upon. The roentgenological examination disclosed duodenal and gastric symptoms which were almost exclusively of a morphological or functional nature. The duodenal symptoms alone are rarely convincing, being observed only in rare cases and occurring in other affections too. The constantly found dilatation of the bulbus duodeni is just as little pathognomonic as the pressure pain at the bulbus, because it is also found at the same spot in affections of the gall bladder, pancreas and appendix, as well as in neurosis. Bismuth remnants in the upper duodenal sections long after the evacuation of the stomach, and simultaneous pressure pain, are rather convincing signs of duodenal ulcer. But as they do not appear constantly except after repeated exposures, they are devoid of practical importance. Duodenal niches are no dependable proof aside from the fact of their infrequent observation. Of greater importance are the radiological symptoms of the stomach: gastroptosis, dextroposition (partial in the pyloric part due to periduodenitis or totally due to inhibition of the tonus with inflation of the colon), pylorofixation, ectasis, spastic hourglass formation, hypertonia with partial or total spasm, pyloric hypofunction (increased contraction, dilatation and propulsion).

The roentgenological symptomatology of duodenal ulcer admits, in the author's opinion, of an interpretation of the pathogenesis attributable to mechano-chemical irritation on the ground of Schlesinger's theory of reflex neurosis.

COLESCHI, A.: Roentgen Diagnosis of the Bilocular Stomach. (*Policlinico*, 1914, No. 3. Ref.: *Zentralbl. f. Roentgenstr.*, Vol. VI, Nos. 9 and 10, 1915.)

A bilocular appearance of the stomach may be temporary, simulated or permanent, according to the causative factors. It may be due to (a) atonia gastrica; (b) compression of the neighboring organs; (c) adhesion of the gastric wall to the neighboring organs; (d) spasms, intermittent or continuous; (e) a true and genuine stenosis in the middle of the stomach. Such stenosis or constriction is usually caused by gastric ulcer, but may also be due to carcinoma or syphilis. A genuine bilocular stomach is always characterized by a certain shape which, in the majority of cases, admits of a differentiation from the spastic forms. The manner of filling may furnish similar information. The roentgen examination should not be terminated too soon, as it may happen that the upper chamber in a bilocular stomach is so large as to simulate the entire or unilocular stomach, and that the evacuation from the upper chamber into the lower takes place very slowly owing to the narrowness of the communicating aperture. When examining an hourglass stomach roentgenologically, the importance of distinguishing between a spastic condition or an organic alteration should be borne in mind.

BOOK REVIEWS

EDITOR, *Edward H. Skinner*, M. D., *Kansas City, Mo.*

THE X-RAYS IN PULMONARY TUBERCULOSIS: THE POSITION OF THE X-RAYS IN THE DIAGNOSIS AND PROGNOSIS OF PULMONARY TUBERCULOSIS. By W. E. Cooke, M.B., M.R.C.P.E., D.P.H. (Lond.), Medical Superintendent Ochil Hills Sanatorium and Coppins Green Industrial Sanatorium. 33 pages, 7 roentgen plates and 5 diagrams. New York, Paul B. Hoeber, 1914. Price $1.50 net.

This neat little monograph is quite practical, being written by the Medical Superintendent of a Tubercular Sanatorium who has maintained an unbiased attitude while studying the value of the roentgen ray in the diagnosis of pulmonary tuberculosis. This is purely a clinico-roentgen study as no technical discussions are included. After quoting briefly from authoritative roentgenologists and unappreciative clinicians, Cooke states his conception of roentgen values as he has found them in his own practice. His conclusions are satisfactory to the roentgenologist and should be reasonable to the clinicians. The reading of this monograph by clinicians should increase their respect for radiologic assistance in the analysis of suspiciously early cases. We recommend the monograph most heartily.

THE CLINICS OF JOHN B. MURPHY, M.D., AT MERCY HOSPITAL, CHICAGO. Volume III, Number III (June, 1916). Octavo of 176 pages, 42 illustrations. Philadelphia and London, W. B. Saunders Company, 1916. Price per year: Paper, $8.00; Cloth, $12.00.

There is an array of abdominal cases reported in this issue the histories of which fail to record the use of the roentgen ray as a factor in their diagnosis. Possibly the careful history and the physical examination is quite sufficient, but in a great teaching clinic it seems that there must be some other fundamental reason for this omission. From the constant perusal of current medical literature and from reports of other large teaching clinics, roentgenologists are led to believe that gastro-intestinal roentgenology is worth while when intelligently interpreted.

Undoubtedly roentgenologists gain from reading Murphy's case histories and it is a pity that roentgenology cannot afford Dr. Murphy a reciprocal advantage.

THE ILEOCÆCAL VALVE. By A. H. Rutherford, M.D., Edin. 61 pages, 34 photographs, 6 plates with tracings. Published by Paul B. Hoeber, New York, 1914. Price $2.25.

It will be remembered that about a century ago Beaumont was fortunate enough to grasp the opportunity of studying gastric digestion in a patient who had an accidental integumento-gastric stoma. His writings, though brief, had an immense influence upon the teachings in gastric physiology during the nineteenth century. Now comes Rutherford who, in May, 1905, had under his observation a case where there was an artificial anus in the cæcum 8 cm. long which permitted a study of the cæcum and the ileocæcal valve. Rutherford's interest led him into a careful analysis of all previous literature upon this valve and to a further study in animals, autopsy specimens and observations at operations. The recent furor upon the ileocæcal valve incompetency creates a demand for just such an anatomical study as this book provides. However, this thesis does not seem to leave the reader satisfied that Rutherford has proved the absolute competency of the ileocæcal valve. There is no doubt but that this book will be widely quoted in further studies because there surely will be many studies of this problem, with the roentgen findings as a basis of interpretation of ileocæcal efficiency.

We cannot refrain from complimenting the author upon the arrangement of this thesis material. It verifies the statement of some wise teacher who was asked as to the best method of presenting a scientific subject to an audience. He answered, "First, tell them what you are going to tell them; second, tell them; third, tell them what you told them."

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